FEBRUARY 1944—FIFTIETH YEAR

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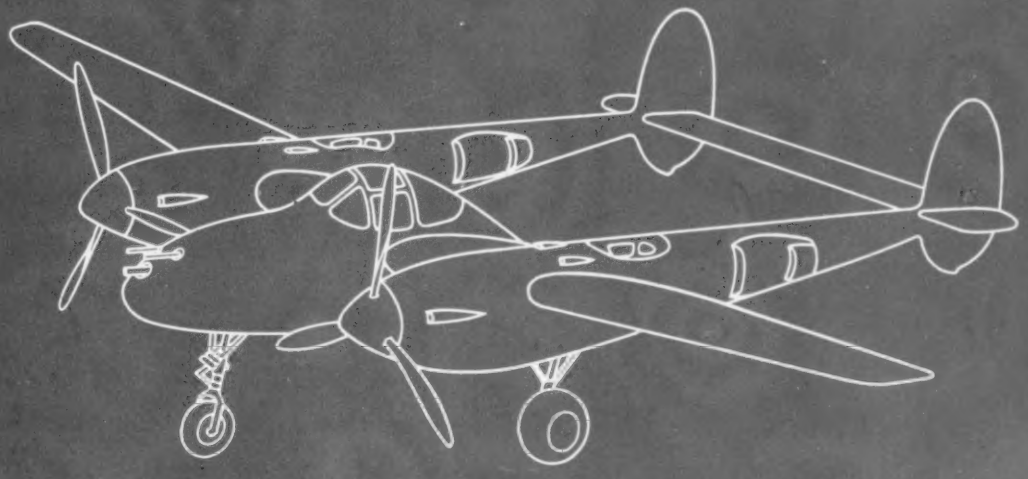

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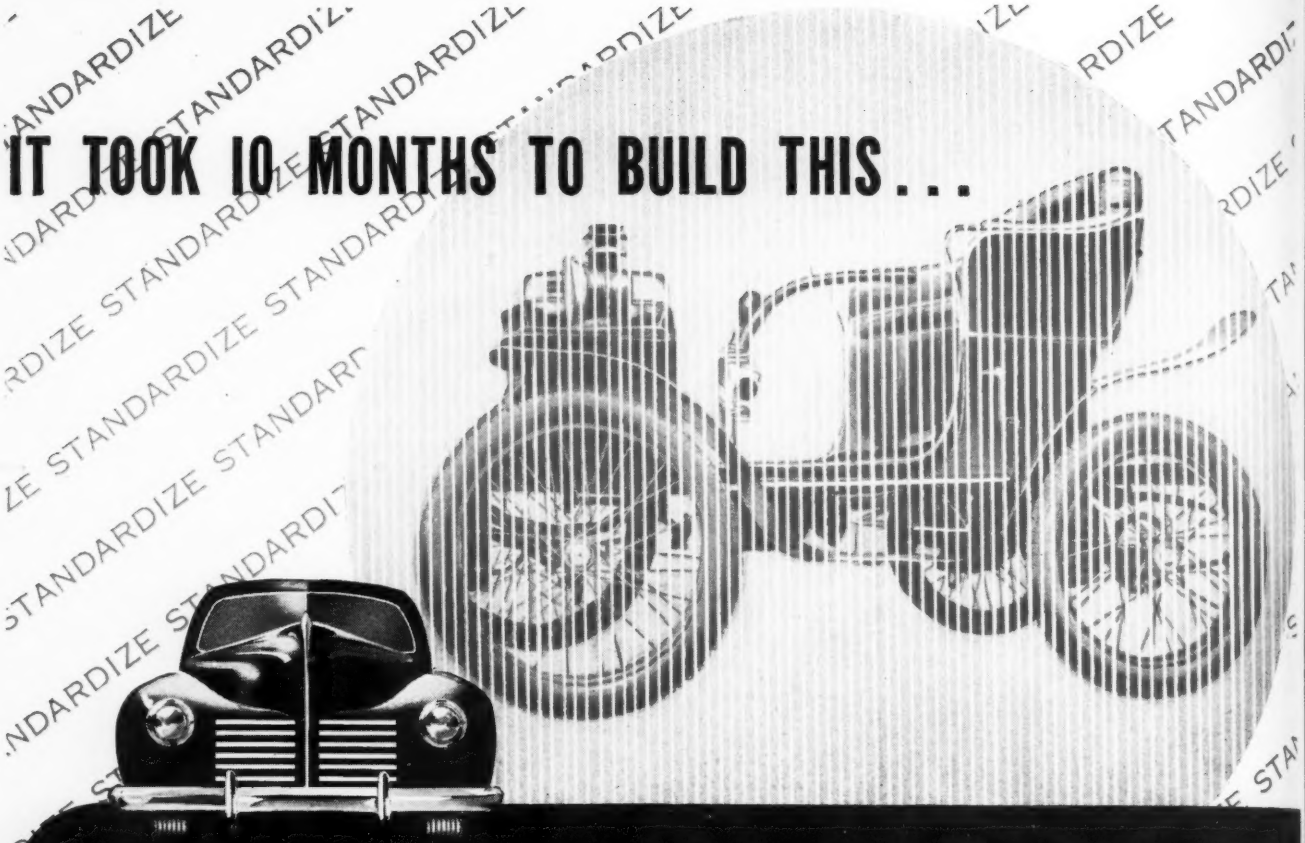

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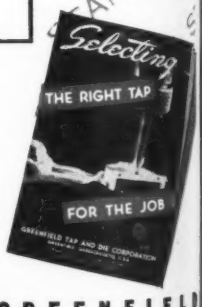

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MACHINERY

FEBRUARY, 1944

Noteworthy advances in metal-cutting practice have been made in recent months under the impetus of America's war effort. Some of these advances, revolutionary in theory, have already demonstrated their practicability in a convincing manner. March MACHINERY will contain a special section presenting comprehensive data pertaining to these outstanding developments. In addition, there will be an article on "Aircraft Production Control," as well as the regular Shop Equipment Section describing the latest designs of machine tools, unit mechanisms, machine parts, and material-handling appliances.

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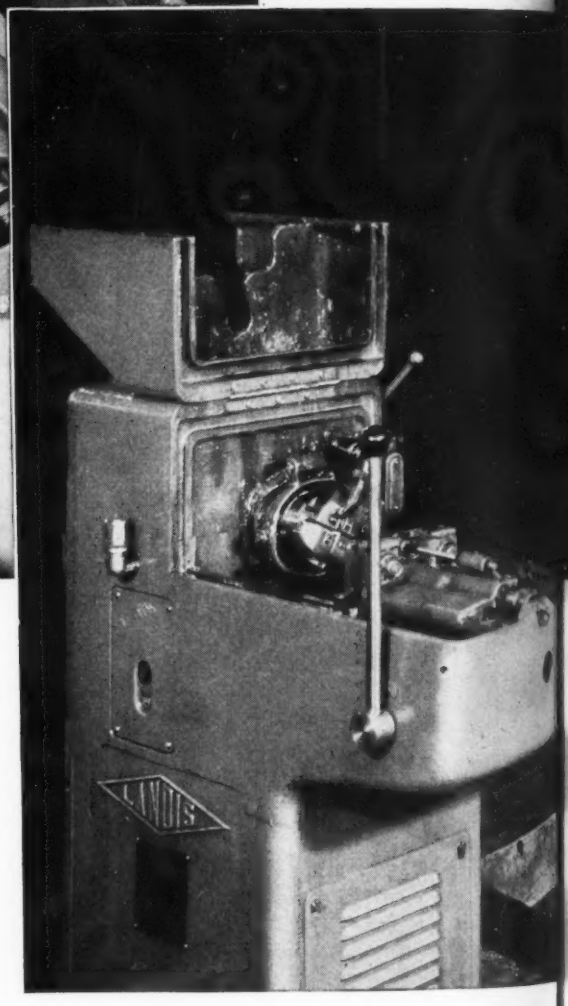

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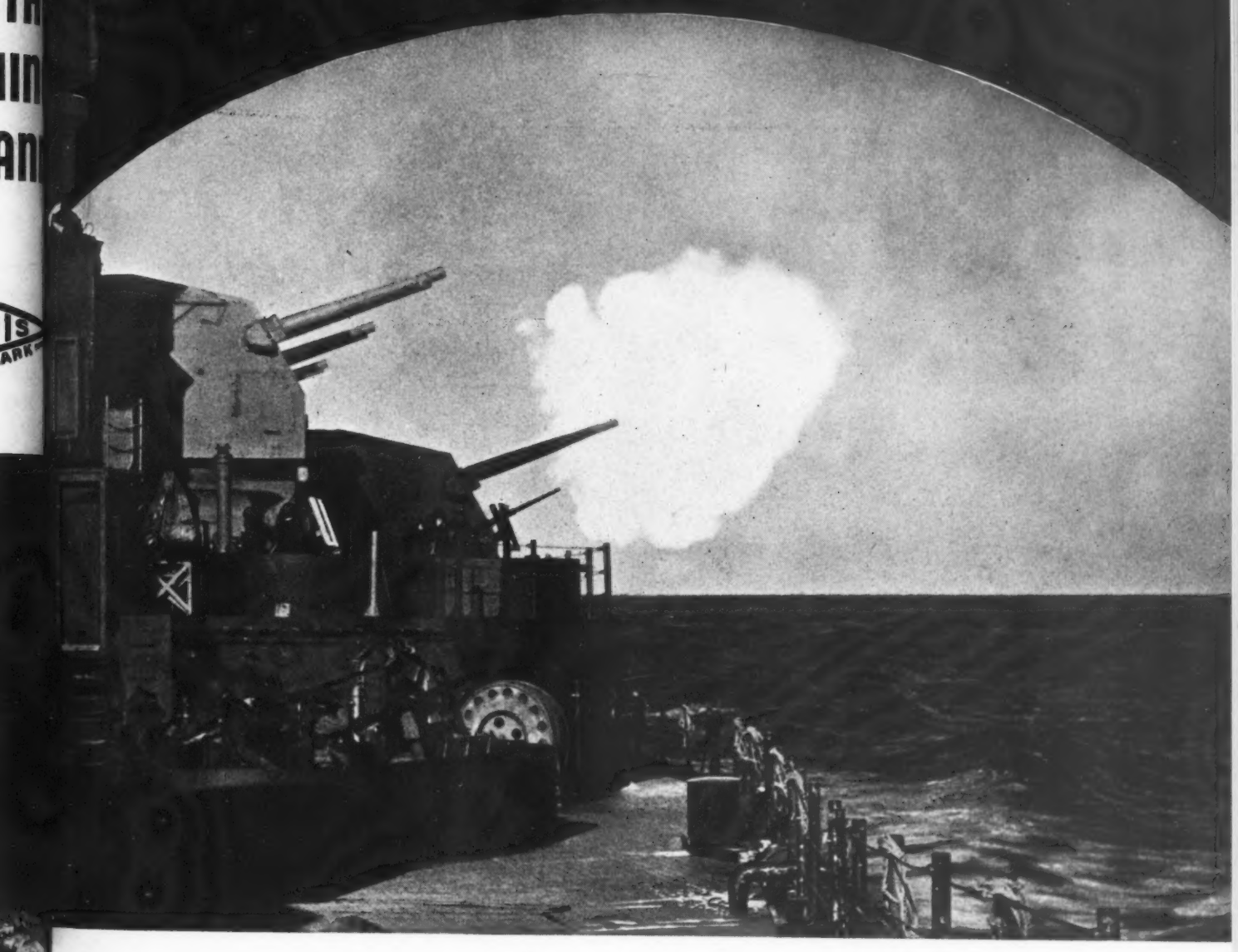

Naval Gun Mounts from a Pacific Coast Shop

By CHARLES O. HERB

WORLD War II has given machine shops on the Pacific Coast an opportunity such as they have never had before of showing the high-grade workmanship that they are capable of performing. Shops that in peacetimes turned out mining, oil-field, agricultural, lumbering, and similar machinery are now manufacturing aircraft parts, ordnance, and marine engines to the closest specifications. The quality of the workmanship

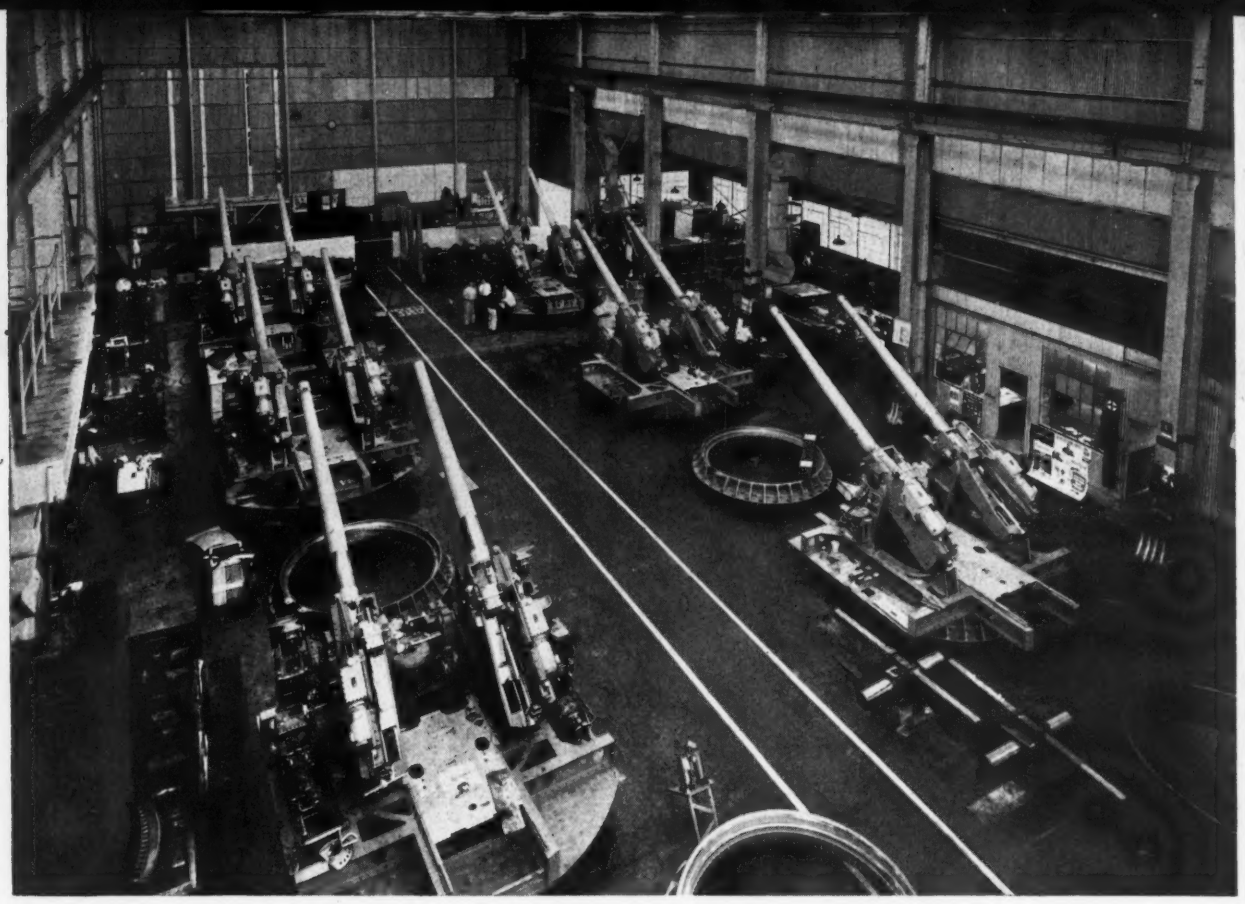

Fig. 1. Dual-purpose Anti-aircraft Guns for United States Battleships on the Erecting Floor at the Maywood Plant of the Consolidated Steel Corporation

is just as good as that of shops in other sections of the country that have always been engaged in producing work to close tolerances.

In pre-war days, the operations of the Consolidated Steel Corporation, Ltd., Los Angeles, Calif., consisted primarily of fabricating and erecting boilers, pressure vessels, and tanks from steel plate, structural steel bridges, buildings, oil derricks, and so on. Since 1940, the principal activity of this concern has been the building of ships, and it has established a reputation for versatility in this enterprise by the large number of different types of vessels launched from its ways and outfitted at its docks. Pennants fly from the several shipyards of the company and its Maywood shops, awarded by the Navy Department and the Maritime Commission for the excellent record achieved in shipbuilding. The Army-Navy "E" also flies over the Maywood shops for performance of the Naval Ordnance Division in building gun mounts for rapid-fire 5-inch anti-aircraft guns.

There are two of these guns on each mount. They can be fired at the rate of twelve shells a minute, the speed of firing being dependent upon the proficiency of the crew in loading and also upon the degree of gun elevation. The guns are extremely effective at heights as high as 30,000 feet.

As an indication of the accuracy demanded on parts for these mounts, it may be pointed out that many limits are expressed in ten-thousandths of an inch. For example, the diameter of the elevating trunnions on the slide must be 6.500 inches within plus 0.0005 inch, minus nothing, and the two trunnions must be in line within 0.0015 inch, although the over-all distance across the two trunnions is approximately 3 feet. Exceptionally close tolerances are specified for other slide dimensions and the parts that operate on the slides. The stand casting must be bored to a diameter of 121.375 inches within plus nothing, minus 0.001 inch.

Each gun carriage must be scraped to fit a master fixture. Jigs have been provided for all major parts, so as to insure complete interchangeability. The mounts leave the plant with the guns and all mechanism installed. In fact,

this is the only shop in the country outside of regular gun factories that installs the electric-hydraulic equipment.

These gun mounts are being delivered from the Consolidated plant at four times the rate agreed upon in the original contract with the Navy Department, and it was the first plant to deliver one of these gun mounts ahead of schedule. The first complete gun was turned over to the Navy six weeks ahead of time, and the first contract was completed seventeen months before the date specified.

Most of the machine tools in the gun mount shop are of the latest types, but there are several cases where the impossibility of obtaining the desired machines made it necessary to adapt existing equipment for the required purpose. For instance, a large planer was needed for finishing the gun mount base rings, and the available planer was much too small, having a span of only 6 feet between the columns. As at least a year would have been lost in waiting for a planer of suitable size, it was decided to rebuild the small planer to accommodate the work.

The columns were moved 16 feet apart and a new cross-rail, rail support, feed-shafts, etc., were provided. A new table was cast and "outriggers" with ways for supporting the table were supplied, in addition to the regular bed. The table, therefore, now slides on four ways.

One of the base rings for which this planer was rebuilt is seen in Fig. 2 on the table of a Betts 20-foot vertical boring mill. This machine is engaged in finishing the roller path support with a gooseneck tool, 1 1/8 inches in width. The vertical shoulder around the roller path is also bored, turned, and faced in the same set-up, and the flange outside of the shoulder is turned and faced. In addition, a recess is cut beneath the outside flange. The flange is 113 inches in diameter, and must be machined to the specified size within plus nothing, minus 0.001 inch. From 0.001 to 0.002 inch of stock is left on top of the shoulder to be removed by scraping.

Four gun carriages are planed at one time on the Sellers planer illustrated in Fig. 3, which takes work up to 72 inches wide between the housings and 72 inches high under the cross-

Fig. 2. Finishing the Roller Path Support on the Base Ring for the Dual-purpose 5-inch Anti-aircraft Guns to the Close Accuracy Specified

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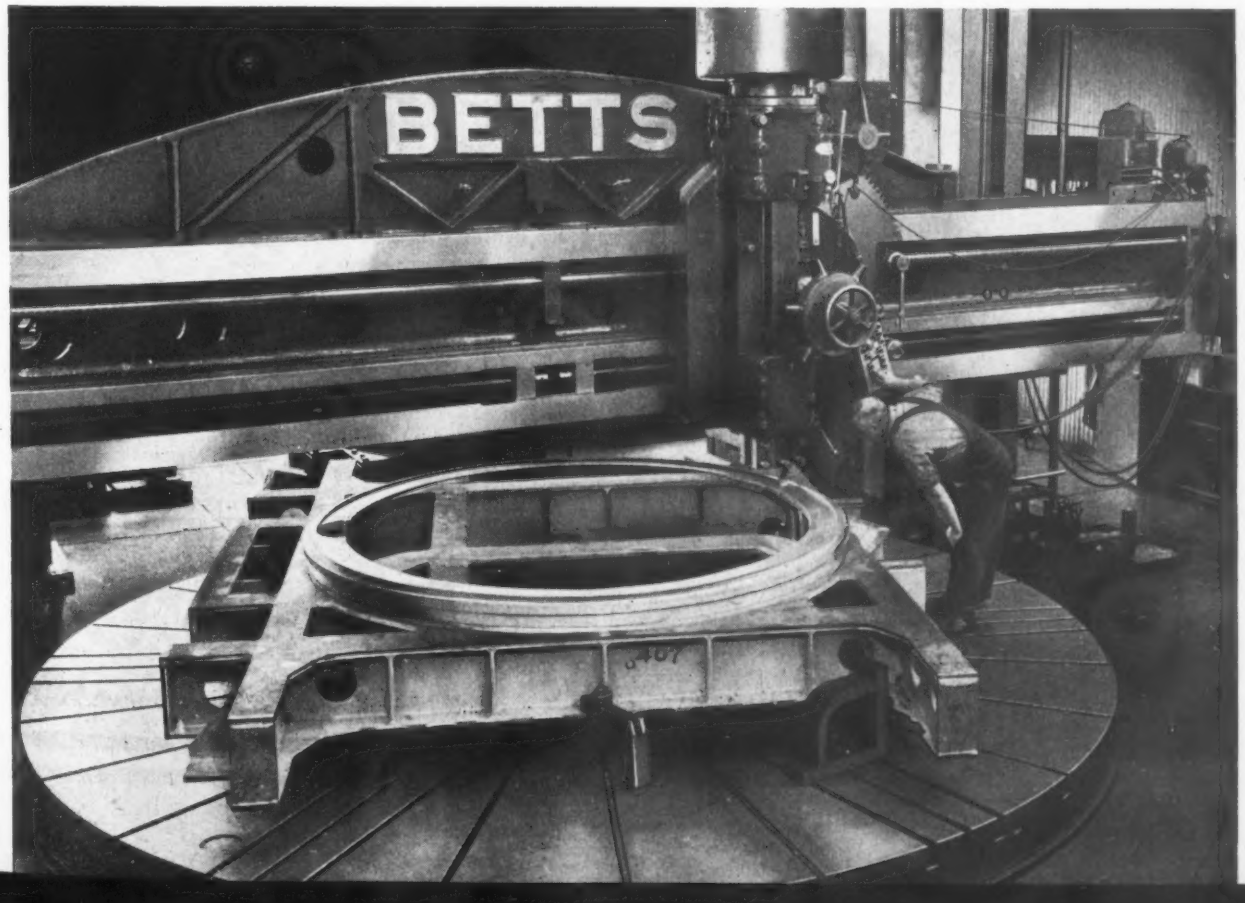
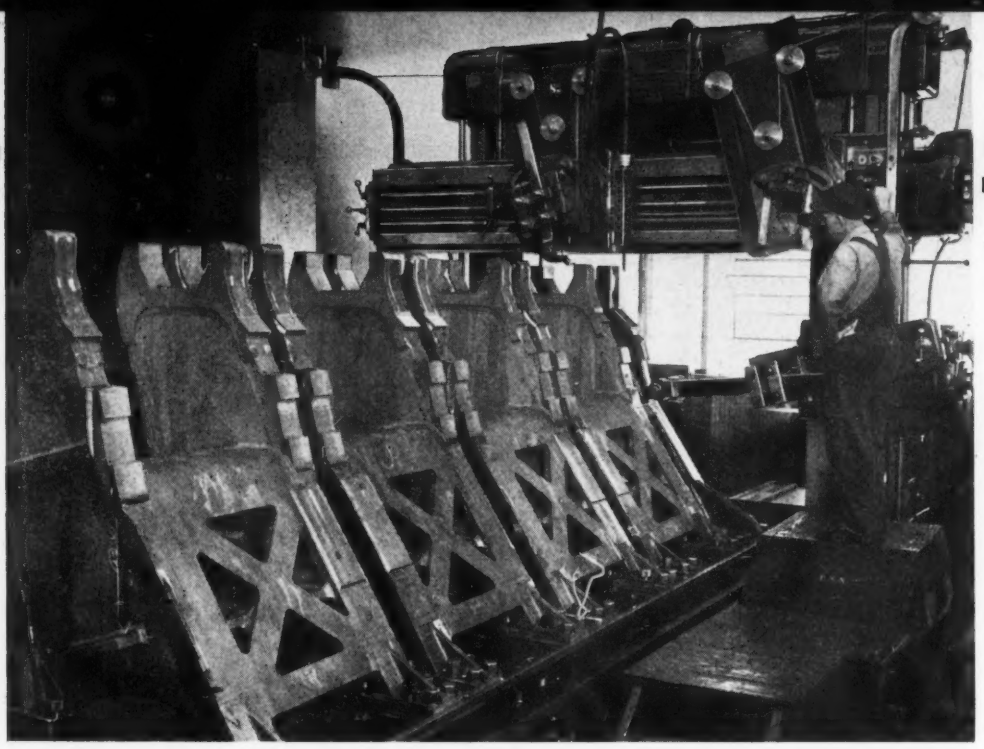




rail. At the time that the photograph was made, a cut was being taken across the yoke at the top of the carriages. These yokes are planed straight across the top, then down vertical and angular sides, and finally, across the bottom. Pads are also planed at angles along one side of the carriages. These gun mount parts are weldments, fabricated from steel plates and drop-forgings. They are all stress-relieved and then Magnafluxed and X-rayed to check the welding before coming to the machine shop.

The various planed surfaces on the carriages are scraped to a master fixture shown in Fig. 4, which is provided with a series of hardened and ground blocks or pads that correspond in location with the finished surfaces of the carriage. A parallel bar supported from chain hoists is laid successively across the scraped carriage surfaces and the locating pads on the fixture to check the accuracy of the important carriage dimensions. The parallel bar is "blued" to facilitate the determination of high spots, and these

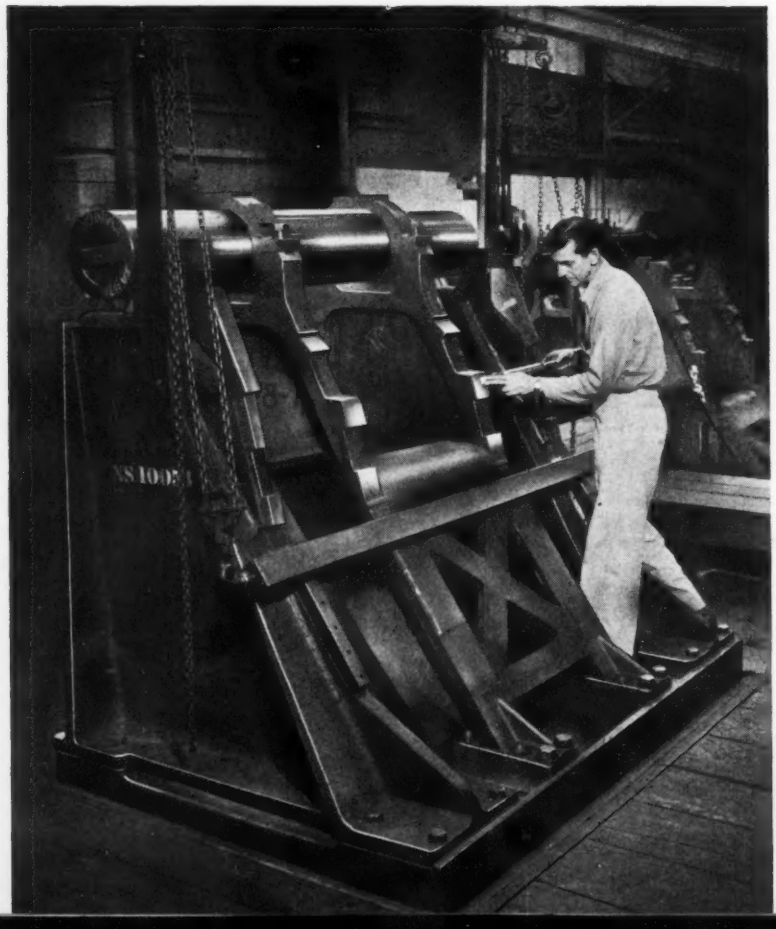
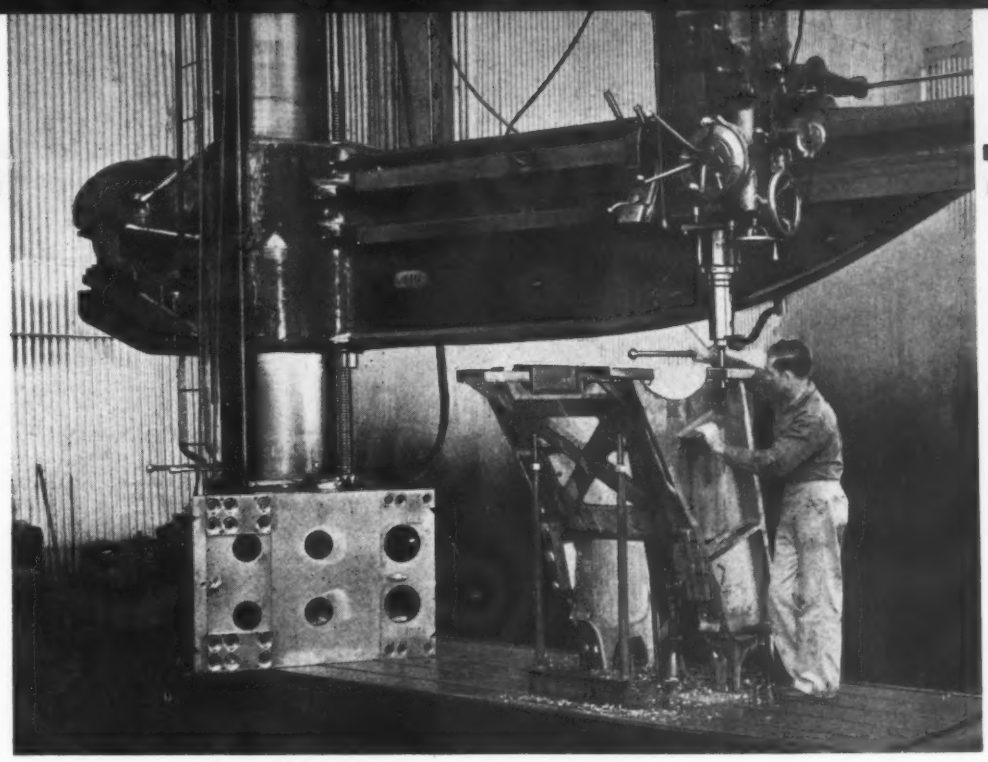


Fig. 3. (Above) Planing Various Surfaces Simultaneously on Four Gun Carriages, Ready for Scraping These Surfaces in Relation to a Master Fixture

Fig. 4. (Left) Master Fixture in which the Planed Surfaces on Every Gun Carriage are Scraped before the Carriage Goes to the Erecting Floor



are eliminated by scraping. The accuracy of the yoke dimensions is checked by suitably ground blocks mounted on a heavy mandrel, as shown in the illustration. For this checking and scraping, the carriage is located from its finished feet, which are bolted to ground pads on the fixture base.

Fig. 5 shows an American radial drilling machine used for drilling, reaming, and back-counterboring the bolt holes in the feet of the carriage weldments prior to the planing and scraping operations just described. Accuracy of the bolt-hole location is assured by the use of the jig plate seen resting against the column. This jig plate is clamped to the bottom of the carriage at the beginning of the operation.

All together, eighteen holes are drilled in the carriage feet to a diameter of 1 7/32 inches through 1 3/4 inches of metal. The holes are then back-counterbored to a diameter of 2 1/2 inches and a depth of 3/4 inch, after which they are reamed to 1 1/4 inches diameter. The jig

Fig. 5. (Above) Eighteen Bolt Holes are Accurately Drilled in the Carriage Feet by the Use of a Drill Jig and then Back-counterbored and Reamed

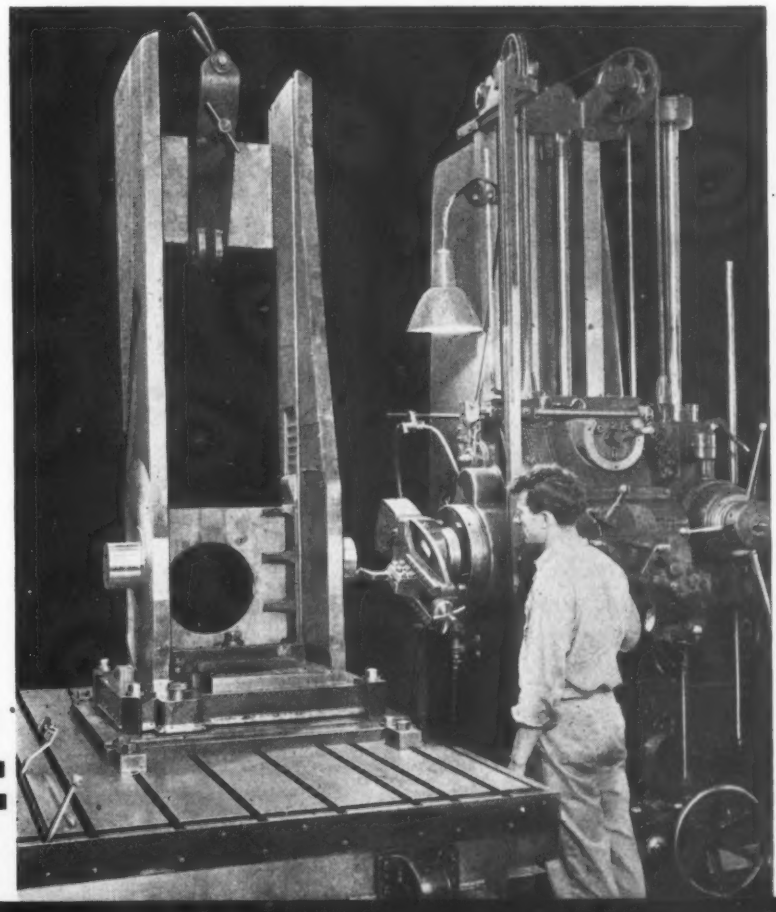


Fig. 6. (Right) Trunnions on Gun Slides are Rough- and Finish-turned in Close Alignment on a Horizontal Boring, Drilling, and Milling Machine

Fig. 7. Special Machine Devised for Simultaneously Turning the Slide Trunnions and also for Grinding the Trunnions

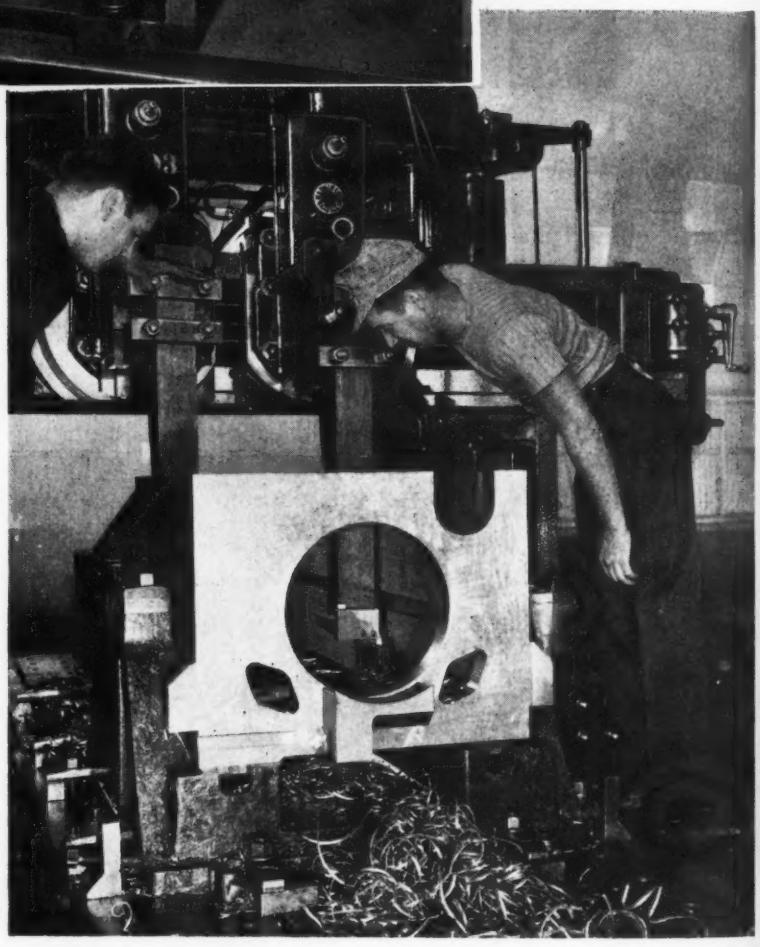


Fig. 8. All Inside Surfaces of the Slides are Finished after the Trunnions have been Ground to Insure Accurate Set-up on the Planer

plate is removed prior to back-counterboring and reaming. The machine has a 14-foot arm and a 24-inch column.

Several operations of unusual interest are performed on the slide weldments. Fig. 6 shows the set-up provided on an Ohio horizontal boring, drilling, and milling machine for turning the slide trunnions. The slide is mounted upright on a fixture that can be indexed to present the two trunnions to the cutter in succession. Turning is done with a gooseneck tool mounted on a counterbalanced arm on the machine spindle. A lead-screw and star-wheel on this arm provide for automatic feeding of the tool in

Fig. 9. Cross-head Guides are Machined all over in a Hydraulic Planer. They are Made in Right- and Left-hand Types

Fig. 10. Right- and Left-hand Rammer Cover Plates are Finished along a Considerable Number of Surfaces by Using a Hydrotel Milling Machine

facing the trunnions. Two turning cuts are taken in roughing the trunnions, during which about 3/8 inch of stock on the diameter is removed. Two or three finishing cuts are then taken in removing from 0.030 to 0.040 inch of stock on the diameter.

The slide trunnions are finish-turned, faced, and ground on the special machine shown in Fig. 7, which is located in a room partitioned off from the remainder of the shop, so that a close control can be maintained of atmospheric conditions. This machine is equipped with a tool-head on each end for simultaneously turning or grinding both trunnions. Either a turning

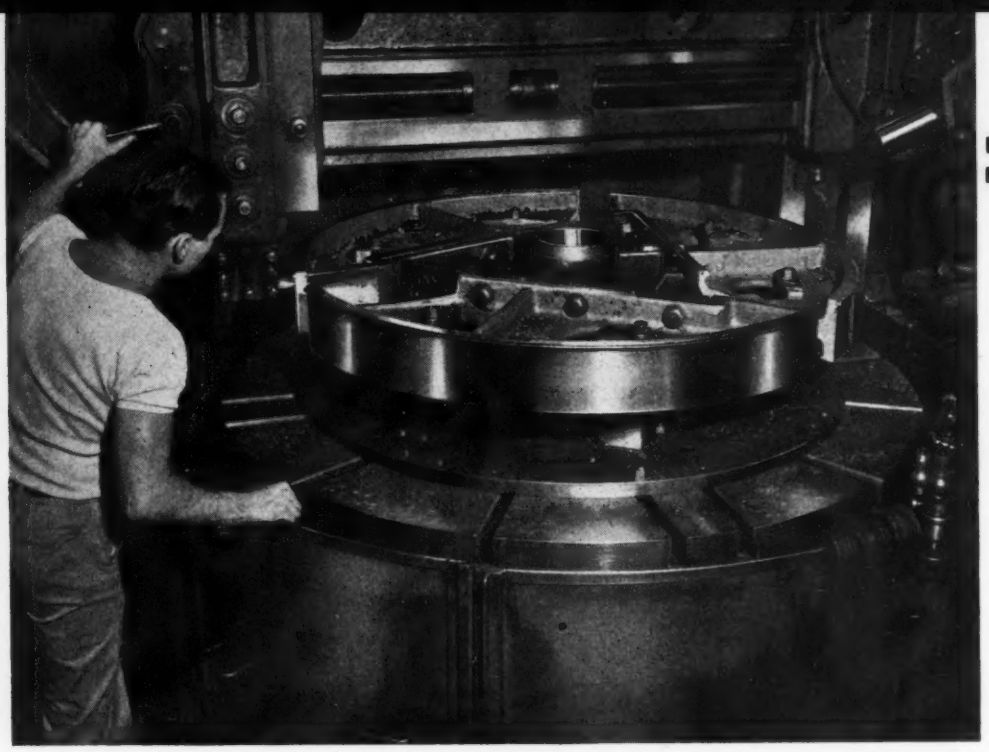


Fig. 11. Three Elevating Arc Brackets are Mounted in a Continuous Circle on the Table of a Boring Mill for Rough- and Finish-turning

tool on a bar can be applied on each head or a grinding spindle as shown. The cutter-bar and grinding head are mounted on a slide on the head, and are therefore adjustable with respect to the circular path to be followed around the trunnion being turned or ground.

In turning, the cutter-bars and tools are held stationary on the slides as they are revolved around the trunnions, similarly to the manner in which the operation is performed on the boring mill. The wheel-spindles of the grinding attachments are driven through V-belts from the tool-head spindles as the wheels are carried around the trunnions. After grinding, the trunnions must be of the diameter mentioned—that is, 6.500 inches within plus 0.0005 inch, minus nothing, and the two trunnions must be in line within 0.0015 inch. The tool-heads of this spe-

Fig. 12. Three Elevating Gear Segments are also Mounted together on a Hobbing Machine to Produce a Complete Circle of Work in Cutting the Teeth

cial machine are also equipped with star feeds for the slides to provide automatic feeding of the cutters in taking facing cuts on the trunnion ends.

Although the end on which the slide is seated for the trunnion turning and grinding operations is finish-machined and scraped prior to those operations, many of the other surfaces are planed after the trunnions have been ground. In Fig. 8, for example, a slide is seen located from the ground trunnions and other finished surfaces for accurate location during the finishing of all inside surfaces on the part. In order to reach some of these surfaces, it is necessary to use tool-bars 36 inches long. Square keyways planed the length of the slide on each inner side must be to size and straight throughout their entire length within 0.001 inch. The machine used for these operations is a Rockford hydraulic planer.

Bronze cross-head guides are machined all over, except for an angular surface that extends

Fig. 13. (Above) Special Fixture Designed for Checking the Radius and Straightness of Gun Port Shields as They are Mounted on Holding Brackets, Ready for Assembly on Guns

Fig. 14. (Right) Fabricating a Gun Mount Base on One of the Large Welding Positioners in the Fabricating Shop

the full length of these castings, in another Rockford hydraulic planer set up as shown in Fig. 9. The castings are approximately 6 feet long. The nature of the various cuts can be observed from the work seen on the machine and the finished guide lying at the front of the table. There are several narrow recesses, a long pocket, and a considerable number of external surfaces, all of which must be finished to specified dimensions within a total tolerance of 0.0015 inch. The average amount of stock removed is 3/8 inch. These guides are made in right- and left-hand styles.

Various surfaces in vertical, horizontal, and angular planes are finished on rammer cover plates by the Hydrotel milling machine seen in Fig. 10. Slots are also produced by means of small end-mills. Two cover plates are mounted in the fixture at a time—one right-hand and the other left-hand. They are 90 inches in over-all length. Hardened and ground pads on the fixture provide a means of setting the cutters quickly to different heights for the various cuts. The tolerance on many of the finished dimensions on these castings is plus or minus 0.001 inch.

Three elevating arc brackets are turned at one time on a King vertical boring mill, set up as shown in Fig. 11 so as to produce a complete circle of work. The brackets are mounted on a three-sided fixture which holds them all to the same radius. They are machined to a diameter of 56 inches within plus or minus 0.001 inch and to an exceptionally smooth finish.

The elevating gear segments which are later mounted on these brackets are hobbed three at a time, arranged to produce a complete circle of work, as seen in Fig. 12. Around the complete circle there are machined 150 teeth of 2 1/2 diametral pitch and of 20-degree pressure angle, stub type. A hob of 5 inches outside diameter is employed. The gear segments are firmly supported on a heavy fixture, and are so closely fitted to the fixture that the joint lines between the segments are difficult to discern.

A fixture designed especially for assembling eight brackets to gun port shields within the required accuracy for mounting on guns is illustrated in Fig. 13. The fixture consists primarily of a stand and swinging arms connected at their outer ends by a cross-bar. The cross-bar is equipped with dial indicators which ride on the edges and top of the shields. In setting up, the brackets are first attached to the fixture stand and then the shield is mounted over the brackets. By swinging the cross-bar of the fixture from one end of the shield to the other and observing the dial readings, the inspector can determine whether the shield is of the specified radius within the required tolerance and whether the edges are straight.

The shields are made of armor plate from 1/2 inch to 1 1/4 inches in thickness. At the end of the bracket setting and checking operation, these shields are dark chromium-plated.

Fabrication of the various gun mount weldments is performed in a building separate from the machine shops. Jigs have been provided in this shop for locating the various members of the weldments within the exacting tolerances required. The weldments are usually tack-welded together in these jigs, and then removed to welding positioners or floor slabs for completion of the welding.

Fig. 14 shows a typical scene in this shop, a gun mount base being welded while supported on a large Cullen-Friestedt positioner. The base consists entirely of steel plate and I-beams. It measures approximately 18 by 16 by 2 1/2 feet, and weighs about 6 1/2 tons.

Production Short-Cuts in Airplane Manufacture

Unusual Methods Developed to Meet Production Problems in Aircraft Building

By RALPH H. RUUD
Assistant Factory Manager
North American Aviation
Inglewood, Calif.

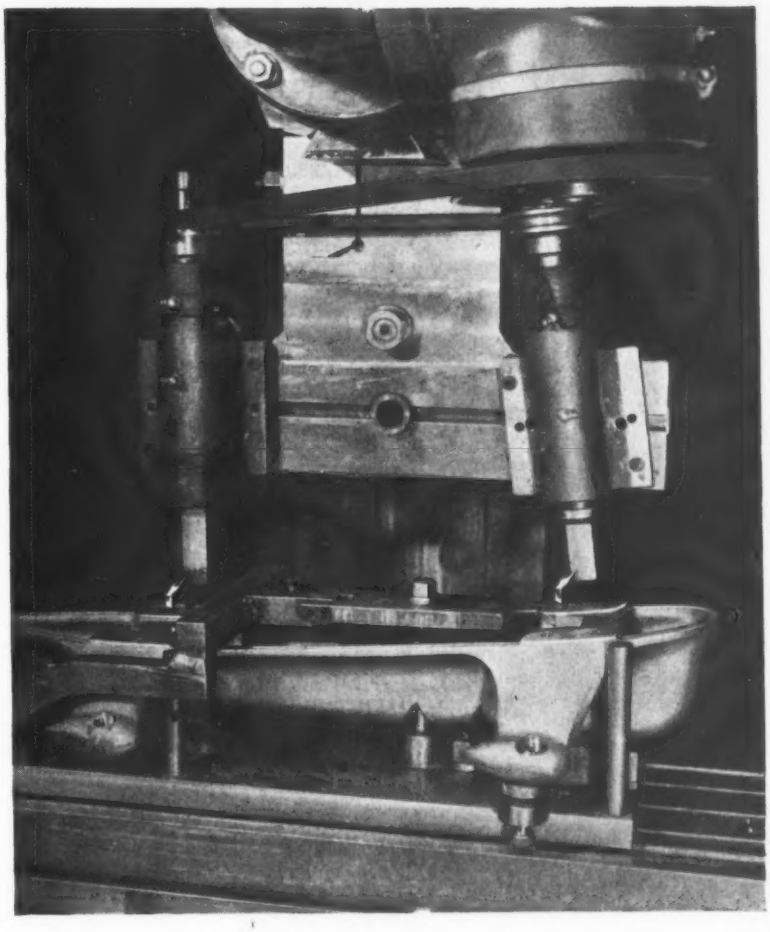


Fig. 1. Special Set-up of Cutter-spindles Devised for Machining Pads at Different Angles on Magnesium Castings

IN an article published in July, 1943, MACHINERY, it was pointed out that standard machines and methods have not yet been developed for producing all types of aircraft parts to the high quality required and in the minimum time demanded. Occasions, therefore, frequently arise when production problems can best be solved through the application of special machines or tools. The article described recent developments in the Inglewood plant of North American Aviation, Inc., to meet production problems peculiar to the aircraft industry. The present article will describe ingenious methods and equipment developed to meet other specific requirements in the same plant.

An unusual set-up devised for simultaneously milling two pads in a horizontal plane on a magnesium casting and two additional pads at a slight angle is shown in Fig. 1. Fly cutters are used for this operation. The cutter-spindle at the left is vertical, as required for machining the horizontal surface, and the spindle at the right is inclined to the necessary angle for milling the other two pads. Both spindles are driven by a V-belt from a large pulley on the regular spindle of the universal head on the milling machine and a V-groove pulley at the upper end of the spindles.

The tool-spindles are run at 1500 R.P.M., and the cutters are set to a radius of 2 inches. The casting is located lengthwise in the fixture by means of a V-block which engages a groove in the under side of the casting near the left-hand end. It is located sidewise at the right-hand end by buttons at the front and back of the fixture, and at the left-hand end by the cross-bar of the large clamping member. This clamp is

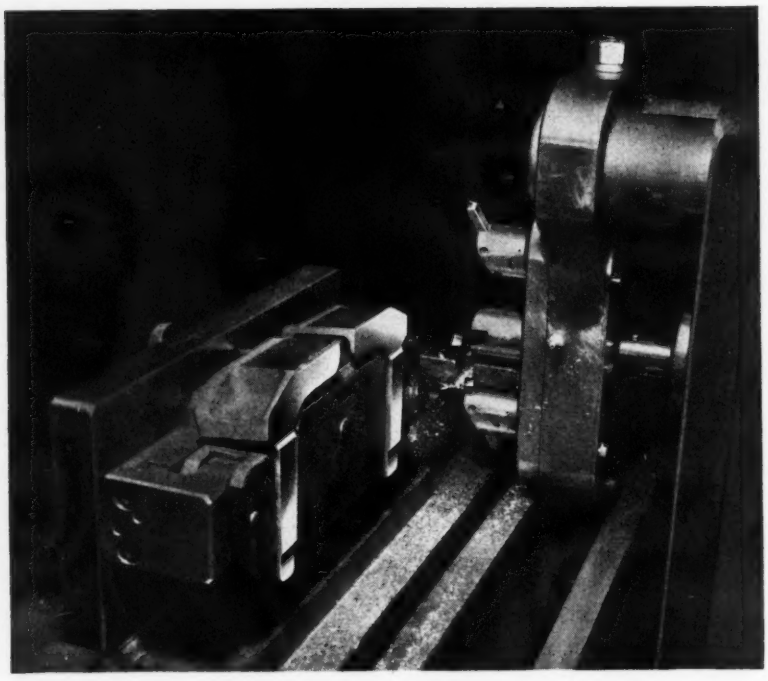
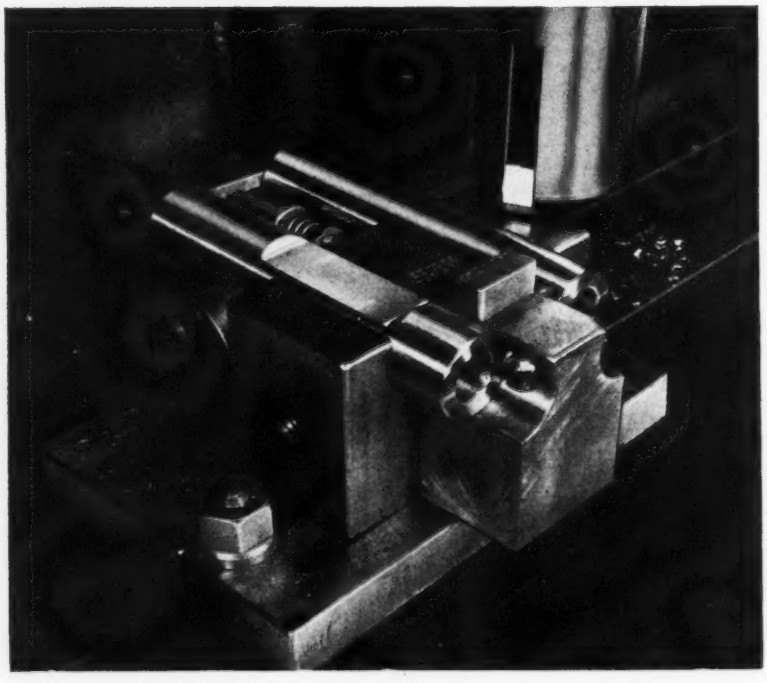


Fig. 2. Duralumin Castings are Machined Simultaneously to Three Different Heights at High Speed with Three Fly Cutters

Fig. 3. Hyper-milling Chromium-molybdenum Steel Bars to a Maximum Depth of 1/4 Inch with a Feed of 9 Inches a Minute



of a double hinged design. It is pivoted on a rod at the left-hand end of the table, and in addition, the short length that is clamped on the approximate top center of the casting is hinged. This arrangement greatly expedites reloading.

Fly cutting is used extensively in the machine shop because of the high speed, fine finish, and accuracy that can be obtained by this method. An operation of this type in which three fly cutters are being used to simultaneously machine a similar number of surfaces to decimal dimensions is illustrated in Fig. 2. The work-pieces are brackets of cast aluminum. Right- and left-hand types are machined together.

Three cutter-spindles are mounted on a special head that is attached to the over-arm of the machine. The central spindle is driven direct from the regular cutter-spindle of the milling machine, while the top and bottom auxiliary spindles are driven from the central spindle through gearing.

Hyper-milling of steel parts by using a fly cutter of negative rake at high speed is also employed to some extent. Fig. 3 illustrates an operation of this type on landing gear lock-pins of chromium-molybdenum steel. The tungsten-carbide tipped cutter is run at 1000 R.P.M., and is fed across the work-pieces at 9 inches a minute. Although the cut is 1/4 inch deep at the maximum point and the chips come off so hot that sparks actually fly, as in grinding operations, the work remains cold and is machined right down to the finished size in one cut. The finish is comparable to that obtained in grinding. Formerly, 0.005 inch of stock was left for removal in a finishing cut. The fly cutter has a negative rake of 10 degrees, and stands up indefinitely under this

severe service. No coolant is used in this operation.

It is necessary to mill comparatively short lengths along spars that range up to 27 feet in length. Previously it was the custom to perform such operations by loading the spars on long milling machines, a practice that was cumbersome and tied up expensive machine tools needed for other work. As a result of this condition, the portable unit shown in Fig. 4 was devised to be attached to the spars themselves at the points to be milled by means of clamps.

The unit is made with two lead-screws which are operated by turning a handle at the front for feeding the tool into the cutting position. Then the carriage is fed along the spar the required distance by turning the handle at the right-hand end of the fixture to actuate a lead-screw that extends lengthwise across the unit. The cutter-spindle is driven from a flexible-shaft machine.

High-production tooling for the milling of motor-mount fittings is shown in Fig. 5. Right- and left-hand fittings, two of each type, are mounted in the fixture at one time, and four cuts are taken on each type. Each piece is placed successively in two positions in the fixture —first either at the front or back, and then in the other position. The time per part is now 1 1/2 minutes, whereas the time required when only one piece was milled at a time was 4 1/2 minutes. The fittings are made from extruded aluminum bars.

Hydraulic cylinders are bored to extreme accuracy by employing the unusual type of boring-bar and long guide bushing seen on the turret lathe in Fig. 6. The boring-bar is fitted with a sleeve directly in back of the tool-head that has seven grooves turned in it to receive Neo-

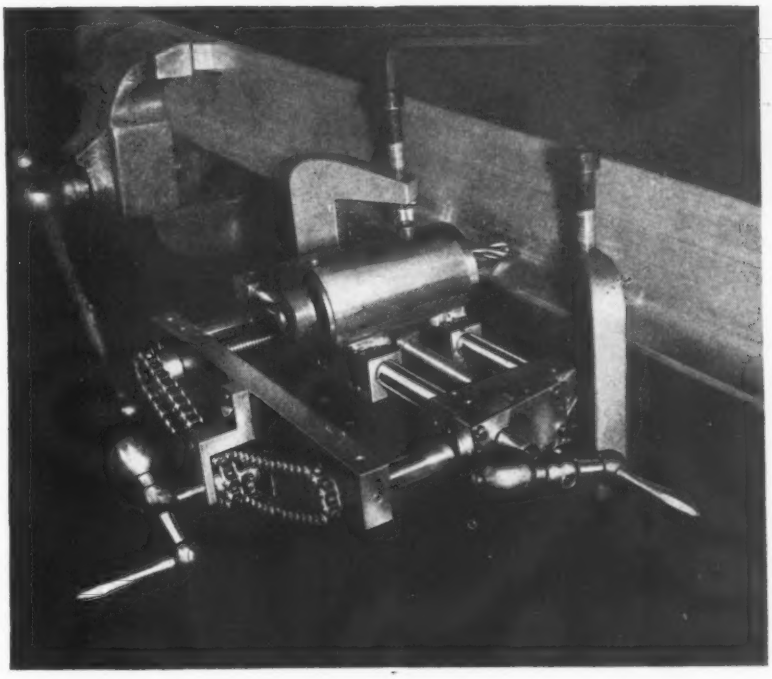
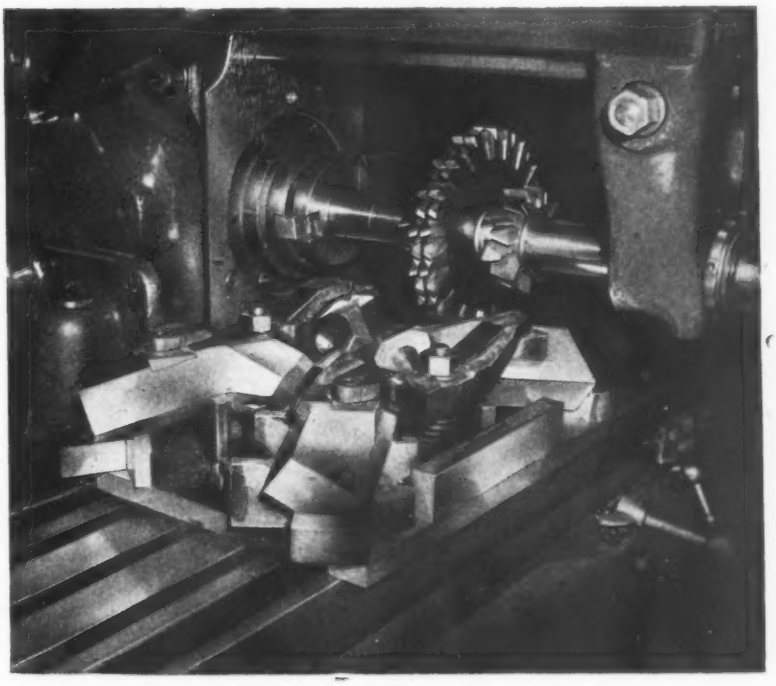


Fig. 4. Portable Milling Equipment Used in Milling Spars for Short Distances without Placing the Spars on Machines

Fig. 5. Typical Milling Set-up Employed to Meet the High-production Demands in the Aircraft Industry



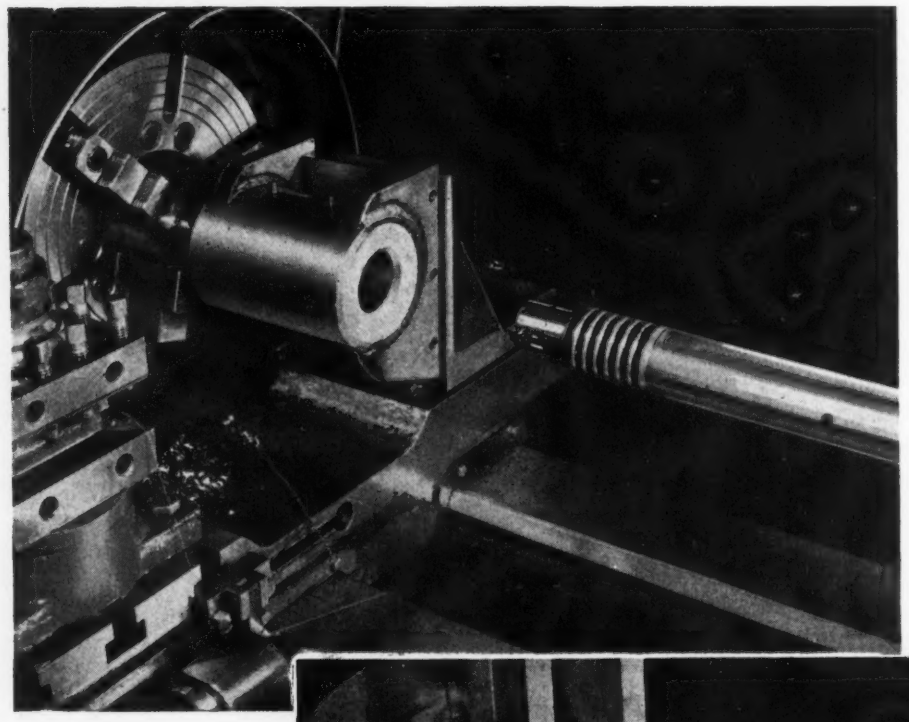
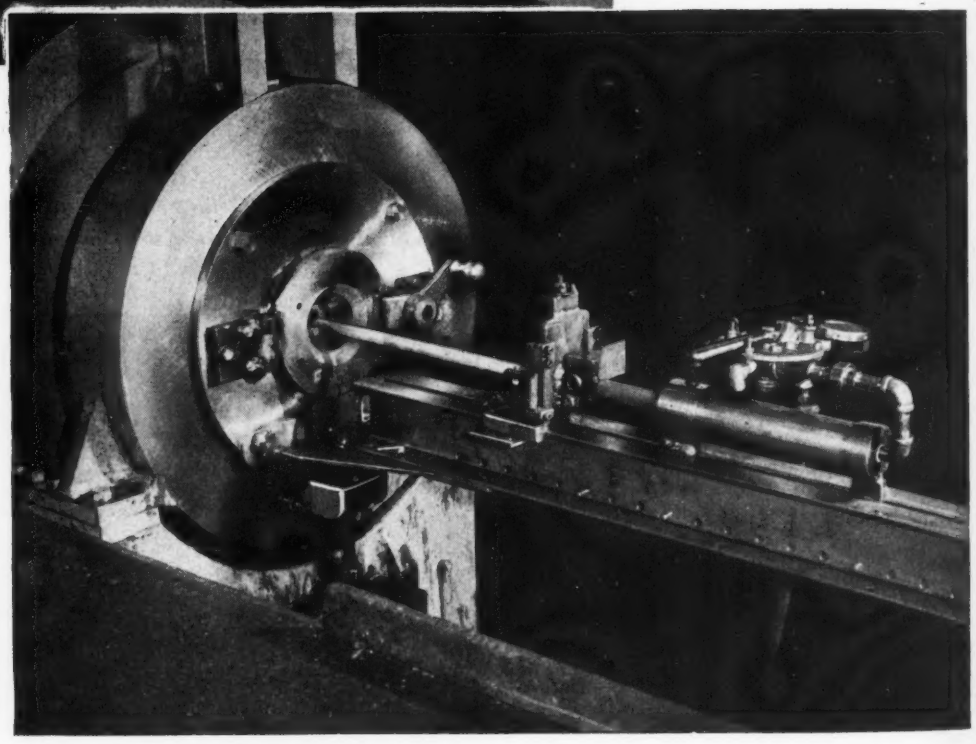


Fig. 6. (Left) Boring Tool with Neoprene Rings and Guide Bushing which Insure Accurate Boring of Long Hydraulic Strut Cylinder

Fig. 7. (Below) Pneumatic Feeding Arrangement which has Speeded up Swaging Operations and also Greatly Improved the Quality of the Work



prene rings. These rings are several thousandths of an inch larger in diameter than the guide bushing. The bushing is mounted on a bracket attached to the cross-slide, and is directly in line with the headstock spindle. The hydraulic cylinder is, of course, held in the spindle.

At the beginning of an operation the Neoprene rings are compressed in the guide bushing, and thus hold the boring head firmly as it is advanced by the hexagon turret to bring roughing and finishing cutters to the work. With this support, the cutters bore without any chatter.

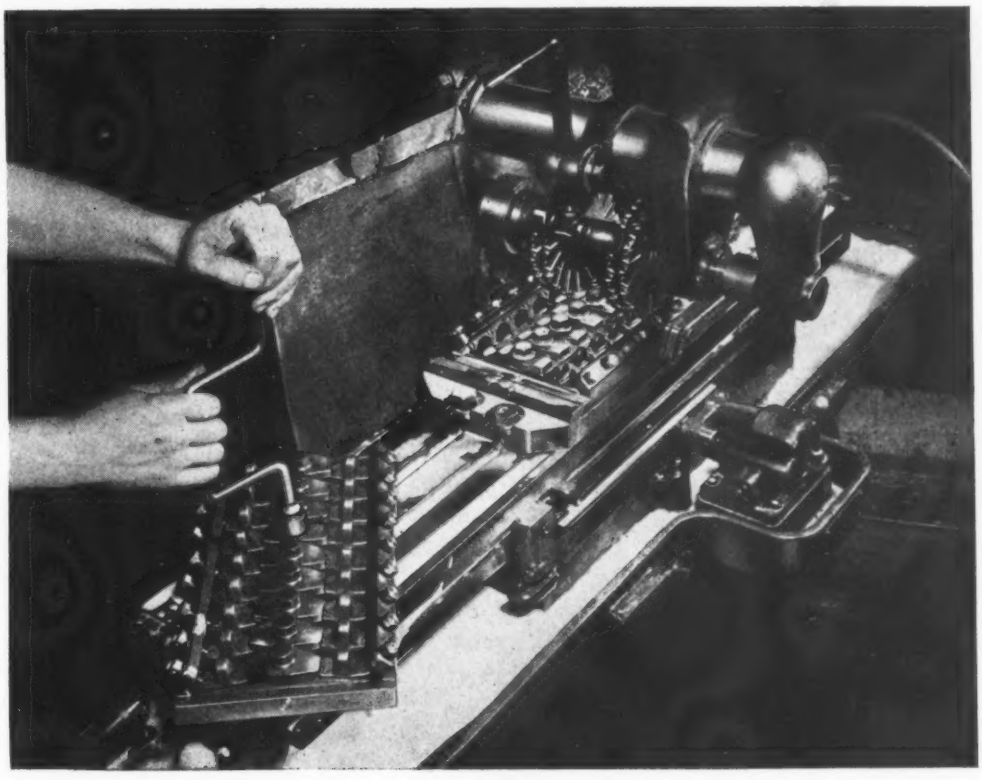
As the cutters advance into the hydraulic cylinder, the Neoprene rings also pass along the bored cylinder, compressed to the diameter of the cylinder, and thus insure a bore that tapers less than 0.001 inch in a length of 30 inches. In many cases, when the tubes from which the hydraulic cylinders are made are received, they are more than 1/8 inch out of alignment, and yet they are bored to the accuracy mentioned in one operation.

Honing is also simplified by this operation, as the cylinders are bored to within 0.003 inch of the finished honed size. Stock to a depth of 1/16 inch per side is removed by the two boring cutters from the chromium-molybdenum steel tubes. Rejection of work is now less than 1 per cent, whereas it was heavy with previous boring methods performed on standard machines.

A device that was developed to eliminate drudgery in swaging operations, but has also resulted in products of improved quality is shown in Fig. 7. It consists simply of an air cylinder which feeds the stock gradually into the swaging head, the stock being supported at the outer end in a V-block that is attached to a slide which is advanced by the air cylinder. It is possible with this arrangement to swage stock down as much as 1/8 inch in one operation, whereas when the stock was held by hand the reduction per operation was about 1/16 inch.

Another advantage of the new method is that stock is swaged to a true circular cross-section instead of elliptically, as often happened in hand-feeding, when the operator sometimes used his body to feed the material into the swaging machine. Also, uniformity of swaging is obtained because of the steady feeding, and there is no tendency for the outer end of the stock to whip. The cylinder has a maximum stroke of 7 inches. The stroke can be definitely limited to any desired amount through the use of a stop. This air cylinder can also be used for swaging tubing that has been bent to various shapes by the use of special work-holding fixtures.

Fig. 8. Fixtures that can be Interchanged on a Base Facilitate Milling of Cowl Flap Hinges



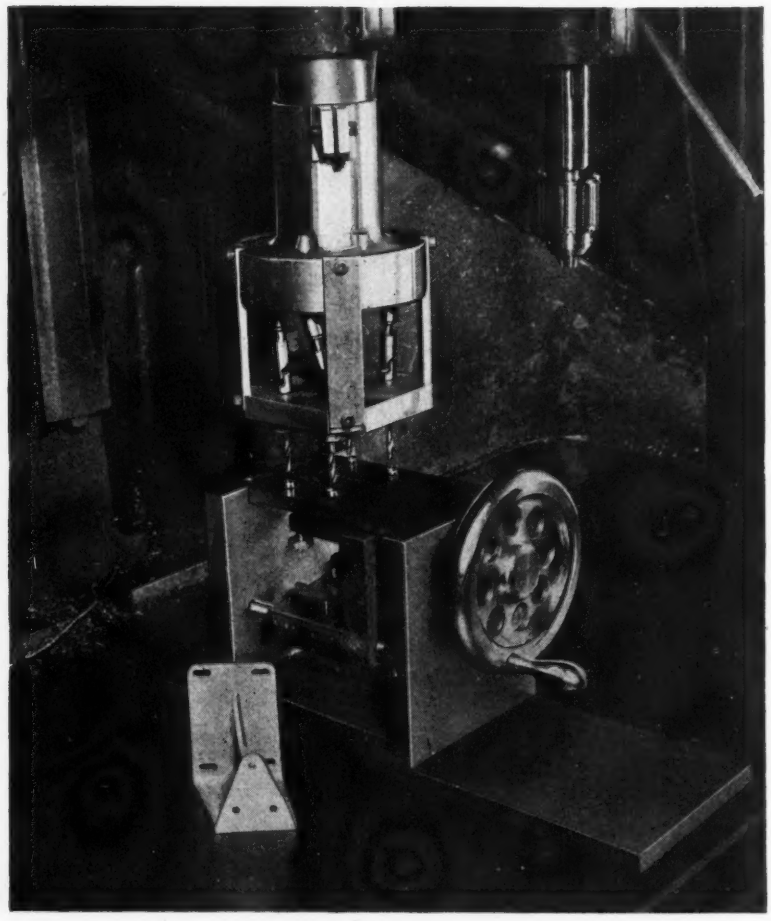


Fig. 9. Drill Head and Special Jig Designed for Cutting Elongated Holes in Cast-aluminum Brackets

As about thirty-six cowl flap hinges are required on each airplane, it was desirable to develop a fast method of milling the extensions on these hinges. This operation is now performed through the use of two fixtures, such as seen in Fig. 8, which hold eighteen hinges each. One fixture can be reloaded while the parts in the other are being milled. Each fixture has a dovetail machined along the ends which fits into a dovetail groove on the base that is bolted to the machine table. In this way, the fixtures can readily be interchanged on the base. Stops on the base insure proper alignment of the fixtures with the four milling cutters.

The machining of four elongated holes in cast-aluminum brackets has been simplified by the use of the special four-spindle drill head and jig shown in Fig. 9. This jig is made with a work-holding slide which can be advanced along the drills after they have been fed through the bracket. The slide is actuated by revolving the handwheel on the front of the jig. Slots can be cut to any length by merely regulating the amount of cross-feed imparted to the work. The drills are, of course, used in the customary way in drilling through the work at the beginning of an operation, but they cut on the sides when elongating the holes.

Attachments that Increase Versatility of High-Production Grinding Machines

How a Wider Variety of Work is Being Handled by the Application of Properly Designed Attachments

By H. E. BALSIGER, Chief Engineer
Landis Tool Co., Waynesboro, Pa.

AN old but constantly recurring grinding problem is how to get high production and great accuracy when grinding a variety of widely different parts, and when lots are so small that a highly specialized single-purpose machine would be idle a large part of the time. This is a problem that faces not only the small so-called job shop, but many high-production shops as well.

In peacetime, many production shops find it difficult to keep a single-purpose machine busy full time, and there are even a lot of shops making munitions which cannot keep such machines busy when operating on a three-shift schedule. In some shops, the machines must be changed every few days, or hours, to handle entirely different pieces. The solution to this problem, of course, is to install either a standard high-production plain cylindrical grinder and give it the necessary versatility by means of attachments and extra equipment or obtain a universal machine and increase its "in-built" versatility in the same way.

Fig. 1 shows a job being done on what is basically a 22- by 48-inch plain hydraulic grinder. The illustration shows this machine equipped with an auxiliary head for grinding small radial airplane-engine crankshaft sections. This auxiliary head is placed on the work-table between the standard headstock and footstock, and can be quickly removed when all of the parts in a lot have been through the operation.

After the radial crankshafts have been assembled, their main bearings are ground on the same machine between centers. This particular machine is also used for a dozen other jobs of cylindrical grinding. It goes without saying that a very big shop which makes such parts

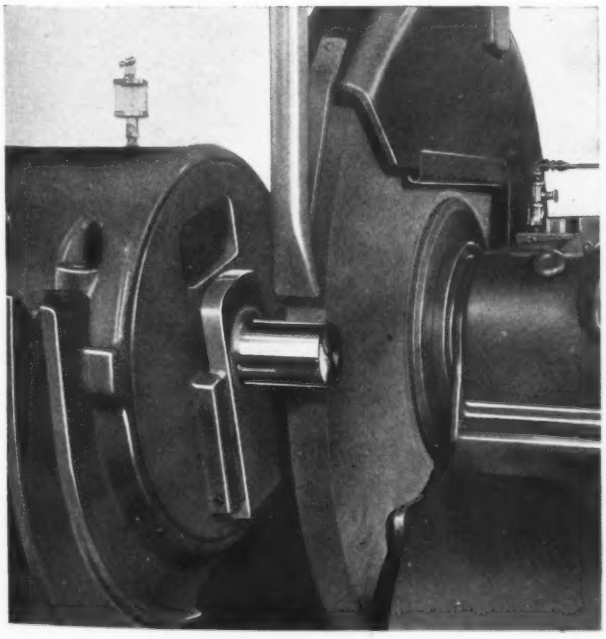


Fig. 1. Plain Hydraulic Grinder Equipped with Auxiliary Head for Grinding Small Radial Engine Crankshaft

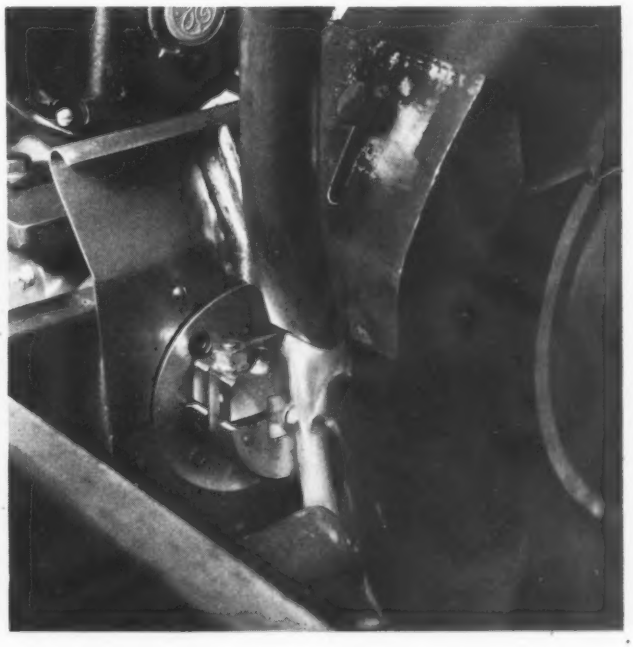


Fig. 2. Grinder with Live-spindle Headstock Fitted with Chuck for Grinding Main-shaft Eccentric for Sewing Machine

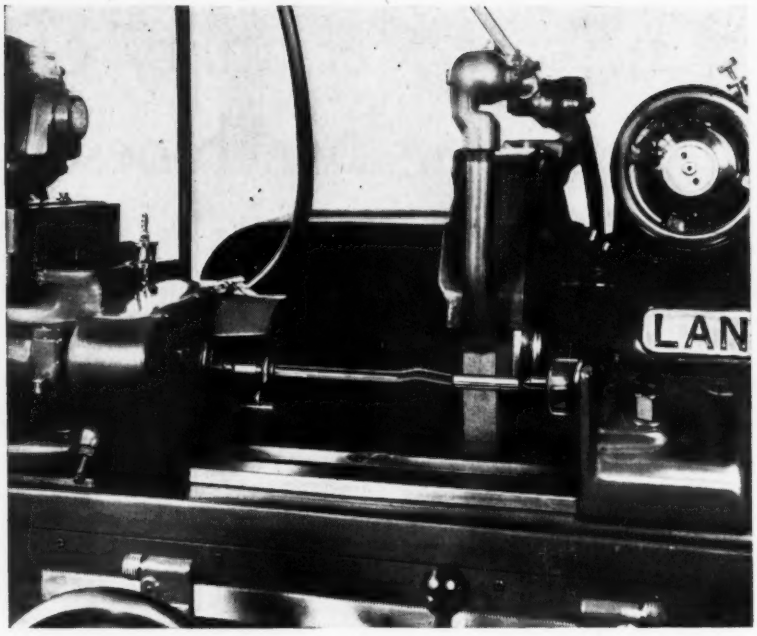


Fig. 3. Plain Hydraulic Cylindrical Grinder Shown in Fig. 2 Set up for Grinding Arm Rotary Shaft between Centers

in large quantities would do better to install special-purpose machines; but the versatility which has been added to this machine enables the smaller shop to take at least partial advantage of the increased productiveness and greater accuracy of this essentially high-production precision machine.

The machine shown in Figs. 2, 3, and 4 is a standard 6- by 18-inch plain hydraulic cylindrical grinder installed in the shop of a sewing machine parts manufacturer. With additional equipment, it is used to grind the three radically different parts shown in the three illustrations. In Fig. 3, an arm rotary shaft is shown being ground between centers. Several other parts are ground on the machine in this wholly conventional manner. Extra equipment includes a live-spindle headstock which can be placed on the worktable without removing the standard headstock. Tooled with the chuck shown in Fig. 2, the live-spindle headstock is used to grind a main-shaft eccentric. With a different chuck, as illustrated in Fig. 4, it is used for grinding a hook eccentric.

As the 6- by 18-inch plain hydraulic grinder shown in Figs. 5 and 6 was originally installed to grind roller-bearing races on a high-production basis, it was equipped with a live-spindle headstock instead of one of the dead-spindle type. This machine even had a Landis-Solex sizing device for use in obtaining maximum accuracy on the highest production basis. This set-up is shown in Fig. 5.

In this case, the high production obtained resulted in the machine running out of its regular race-grinding work periodically. A standard footstock and a special headstock center were, therefore, purchased, which can be quickly substituted for the race-holding chuck. This makes the machine suitable for all kinds of between-center grinding within its range, as, for example, the shaft shown in Fig. 6.

In Figs. 7 and 8 is shown a 6- by 30-inch standard plain hydraulic machine equipped with ingenious attachments that enable the machine to be used for internal grinding of the bores and chamfers of small spindles, as well as for the ordinary run of straight cylindrical grinding. Although a machine was required on which internal jobs could be ground, these parts use up only 10 per cent of the machine's total operating time. There was, however, sufficient straight cylindrical grinding to keep the machine busy the other 90 per cent of the time. The extra equipment consists of a special bracket carrying two air-operated internal portable grinders, which have no difficulty in grinding to limits of plus 0.0003, minus 0.000

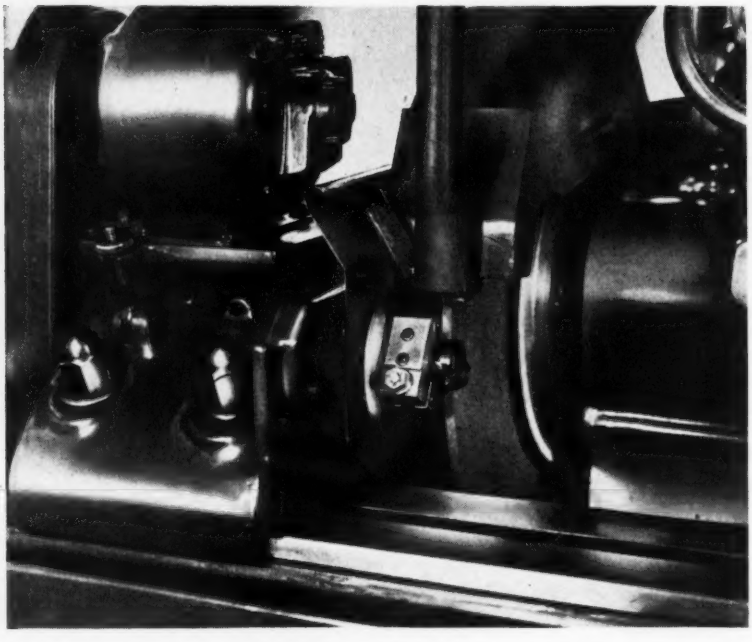


Fig. 4. Machine Shown in Fig. 2 Equipped with Special Chuck for Grinding a Hook Eccentric

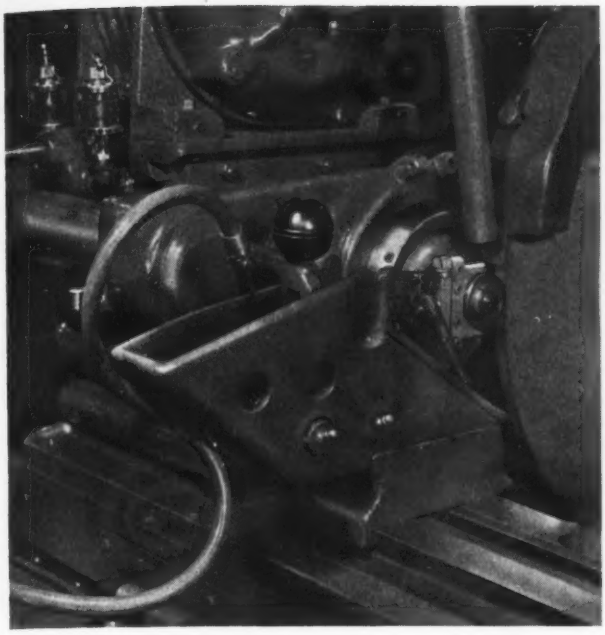


Fig. 5. Plain Hydraulic Grinder Equipped with Live-spindle Headstock and Landis-Solex Sizing Device for Use in Grinding Roller-bearing Races

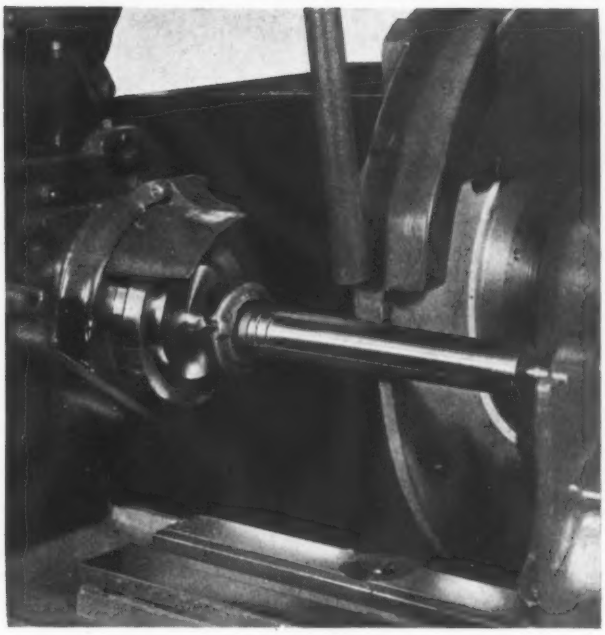


Fig. 6. Machine Shown in Fig. 5 Adapted for a Variety of between-center Grinding by Adding Footstock and Using a Special Headstock Center

inch. Production for the internal grinding operation averages fourteen to sixteen pieces per hour.

In adding versatility of this sort to production grinders, it is essential to so design the extra equipment that the change-over can be made quickly. So excellently were the fixtures designed by the shop that owns the machine that to change the plain grinder from the set-up for between-center grinding to the set-up for special internal grinding takes less than thirty minutes.

In Fig. 9 is shown a standard 14- by 72-inch

Fig. 7. Plain Cylindrical Grinding Machine Equipped with Attachments for Internal Grinding Operations

Fig. 8. Performing Chamfer-grinding Operations on Machine Shown in Fig. 7, Using Special Attachment

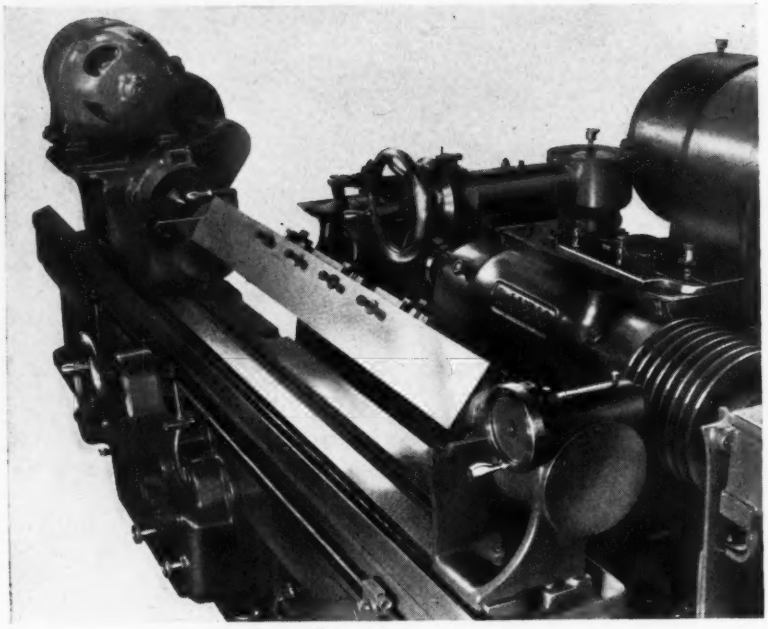


Fig. 9. Plain Hydraulic Grinding Machine Equipped with a Knife-grinding Attachment and a Special Grinding Head

plain hydraulic grinder that is used for the general run of regular cylindrical grinding between centers. It is also used for the grinding of small straight-faced rolls. As shown, it is equipped with a knife-grinding attachment, which is clamped to the top of the work-table after the headstock and footstock have been removed. Also, a special grinding head is clamped to the left-hand side of the wheel-base after the standard wheel and wheel guard have been taken off.

It is worth noting that machine knives are usually ground on surface grinders—not cylindrical grinders. Without this adaptation, the shop would doubtless have had to invest in a surface grinder, which it could not have kept in continuous operation.

Some automotive and airplane pistons have to be first ground round and then given an elliptical form across the pin-holes. This is commonly called "relieving," and is done so that when the piston becomes heated in use, it will take the form of a circle at that point. The piston expands more at the pin-holes than elsewhere because of the greater mass of metal there. The job is done on a standard plain hydraulic grinder equipped with a cam-grinding attachment. The piston is first circle-ground, with the cam-grinding attachment disconnected; the attachment is then put into operation for grinding the relief.

If it is necessary to grind several sizes of pistons in small lots, the machine can be equipped with several master cams and the master cam roller arranged so that it can be moved longitudinally. When the set-up is changed from one size piston to another, the roller is moved to the master cam needed for the new piston.

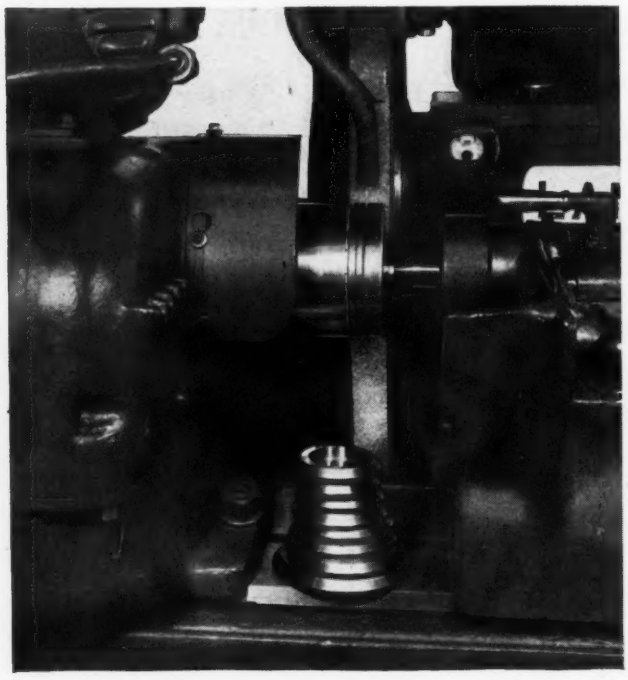


Fig. 10. Grinding Outside of Automotive Pistons on Hydraulic Universal Grinding Machine

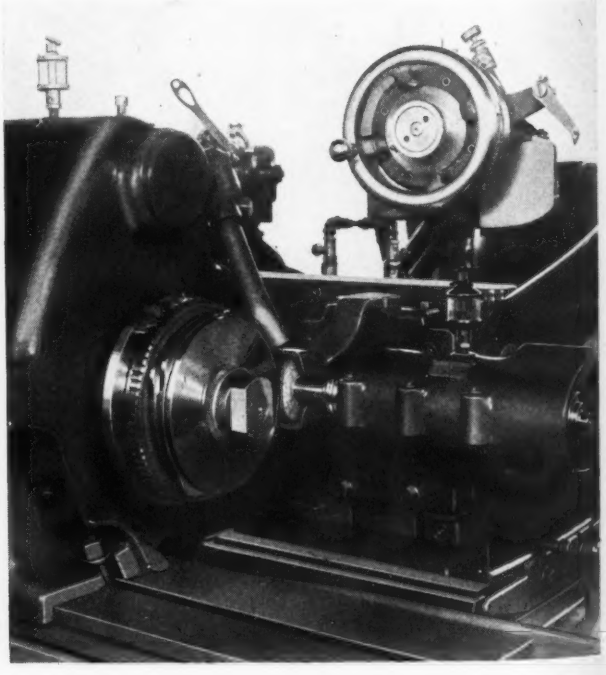
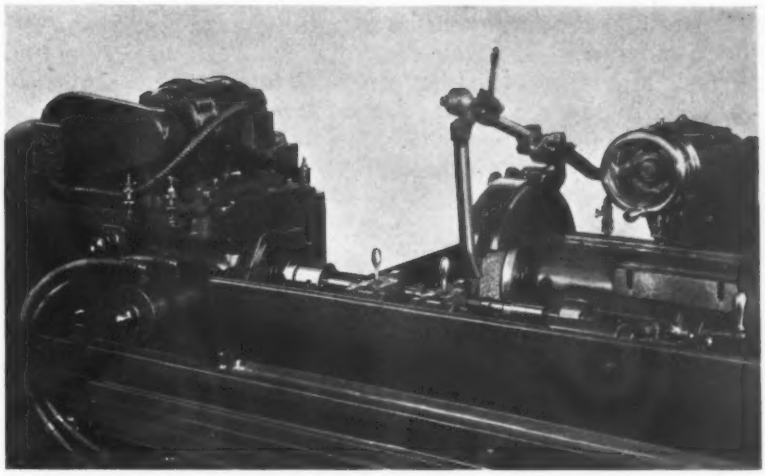


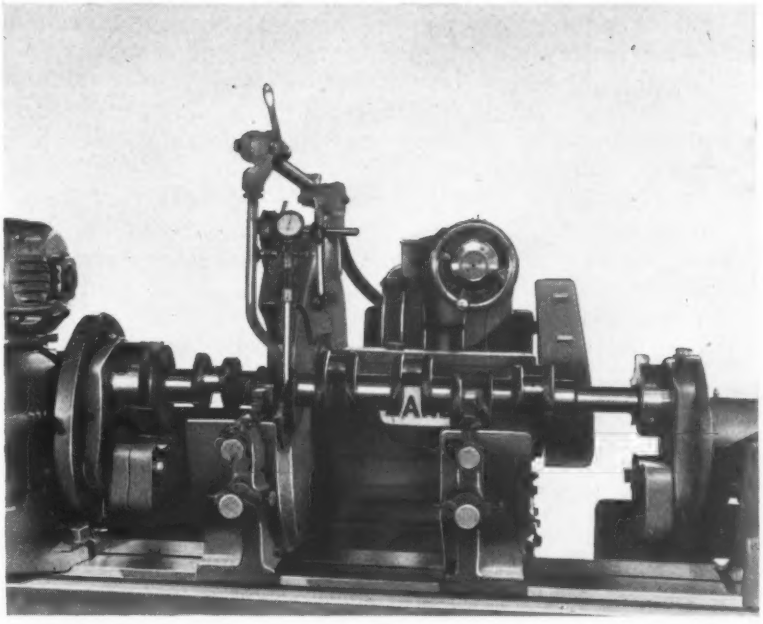
Fig. 11. Heavy Hydraulic Universal Grinder Set up for Grinding Cams for Radial Airplane Engines

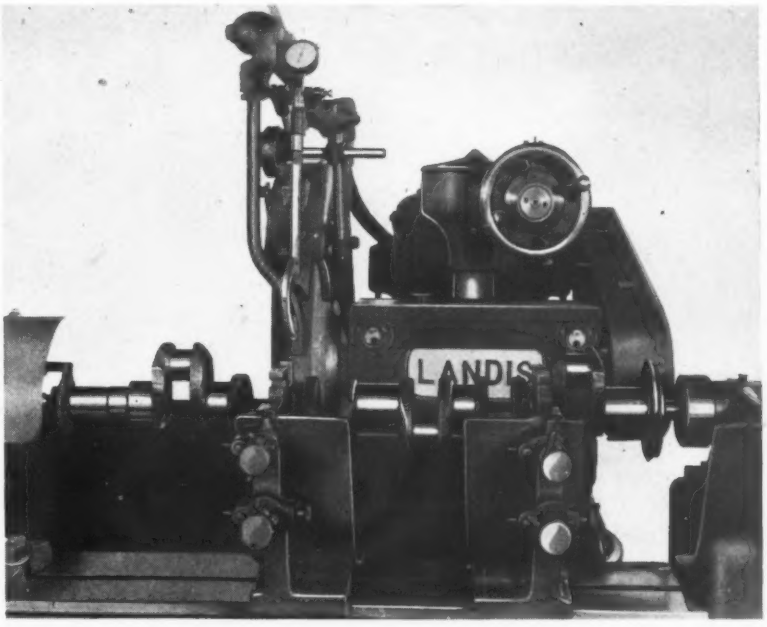
Fig. 12. (Top) Hydraulic Universal Grinding Machine Equipped for Grinding Cams for Diesel Engines

Fig. 13. (Center) Machine with Crank-carrying Fixture Designed for Crankpin-grinding Operations

Fig. 14. (Bottom) Hydraulic Grinder Set up for Grinding Main Bearings of Shaft Shown in Fig. 13







While universal machines have a great deal of versatility built into them, there are times when still more can effectively be added. Take, for example, the heavy hydraulic universal grinder shown in Fig. 11, which is used in a rather small shop making airplane motors for a wide variety of cylindrical between-center, internal, and face grinding with standard equipment. The production was not sufficient to warrant buying a special radial cam-grinding machine, yet the shop wished to make the cam for the motor, itself. This machine was adapted for the job by placing a loose cam-grinding attachment on the table and equipping the machine with an internal grinding fixture to grind the re-entrant curve. Because of the wide variety of parts that this universal machine can turn out, it is kept busy full time.

A small manufacturer of Diesel engines did not have enough cam grinding to warrant buying a specialized high-production cam grinder; and while he required a machine capable of a high degree of accuracy, he also wanted to obtain as high production as possible. He solved this problem with the 14- by 72-inch hydraulic universal grinder shown in Fig. 12. With it he procured an integral cam-grinding attachment which can quickly be attached to the machine after removing the standard work-table. When equipped with the standard work-table, the machine is used for a wide variety of between-center, internal, and face grinding operations.

The machine shown in Figs. 13 and 14 is basically a standard 14- by 72-inch hydraulic universal, but

when equipped as this one is, we call it a crankshaft regrinder. It was specially equipped to make it of the greatest usefulness to shops specializing in the reconditioning of internal-combustion engines.

When the greatest versatility is desired, the equipment includes the following: Universal headstock; handwheel-operated footstock; a set of adjustable crank-carrying fixtures, including chucks and balancing weights; crank-centering gage; plain handwheel feed; 28-inch grinding wheel (which is larger than that used on the standard machine); work-rests; piston-driving fixture with rings for pistons from 2 3/4 to 5 inches in diameter; a removable bracket type internal grinding fixture or a swinging bracket type fixture; a T-slot faceplate; a four-jaw chuck; and a cutter chuck.

With this equipment, the machine can do any kind of between-center cylindrical grinding, including the grinding of crankshaft bearings; by using the crank-carrying fixture, the crankpins can be ground; by utilizing the special driving fixture which is inserted in the end of the headstock spindle after removing the standard work-center, pistons can be ground. Other automotive parts that are regularly ground on this versatile machine are wrist-pins, push-rods, valve faces, main camshaft bearings, and bushings. With the internal grinding attachment, transmission gears, small air-compressor cylinders, and bushings are ground on the inside diameter.

Fig. 13 shows a crankpin grinding operation, including the crank-carrying fixture. Fig. 14 shows the grinding of the main bearings of the same shaft in the conventional manner between centers. Fig. 10 shows the same machine used for the grinding of the outside diameter of pistons. In the foreground is a complete set of the rings used in the piston-holding fixture. These examples from actual practice indicate how one may add versatility to machines instead of adding new machines.

* * *

Milling Opposite Sides of Aircraft Engine Parts with Carbide Cutters

Oil-pump bodies, covers, and similar parts for aircraft engines, which require machining on opposite, parallel sides are milled by the Wright Aeronautical Corporation, Paterson, N. J., on a four-spindle Cincinnati Hydromatic. The parts are clamped edgewise in a fixture, as shown in the accompanying illustration, and are first passed between a pair of carbide-tipped face mills for rough milling, approximately 1/8 inch of stock being removed on each side of the work. The parts then pass between a second pair of straddle-milling cutters which take a finishing cut of 0.020 inch.

On the return stroke of the table, the cutters open up to avoid marring the surface, closing again to the cutting position at the beginning of the next forward stroke. The distance between opposite faces of the work-pieces is held to a total tolerance of 0.0005 inch.

Cincinnati Hydromatic Milling Machine Provided with Two Sets of Carbide-tipped Straddle-milling Cutters for Taking Rough- and Finish-milling Cuts at One Pass of the Table

A Method for Determining Speeds and Feeds for Milling Operations

To Get the Most out of Milling Machines and Cutters, the Most Effective Feeds and Speeds Must be Used. This Article Describes How These were Determined in One War Production Plant

By S. C. BLISS

A CHANGE in the method of wage payment from day work to a bonus system made it necessary to devise a method for setting standards for machining operations. Since this occurred in a war production plant that had been in operation for but a short time, many of the operators and even the foremen were recently trained men. Furthermore, the material being machined was a special steel with which very few men in the organization had had any experience.

It was decided to establish speeds and feeds for the machining operations before time studies were made. By doing this, it was possible to have the time studies made by comparatively inexperienced workers. A small group was organized and trained for establishing speeds and feeds. The values determined upon were issued in a bulletin form to the various departments before time studies were made.

The first thing that the time-study observer did was to see that the operator used the feeds and speeds specified. If he did not, the reason was investigated. It was found necessary to revise very few of the feeds and speeds set.

The setting of speeds and feeds for drilling and turning operations was simple. In the case of milling operations, however, there was not a great deal of information, particularly with reference to feeds. About all that was available were tables giving allowable feed per tooth. Since there were over 1000 milling machines in the plant and the material to be milled was a special steel with from 200 to 230 Brinell hardness, correct speeds and feeds for milling were of especial importance.

Method for Determining Milling Speeds and Feeds

Generally, it will be found that wherever there are a number of similar machining operations performed in a newly established plant, there are surprising variations in the speeds and feeds used. The condition of the machine and the character of the cutter and fixture will account for some of these variations; but in most cases, there are no valid reasons for them.

Hence, a number of typical milling operations were analyzed and the data obtained was used as a basis for setting all milling speeds and feeds. The standards thus established were based on actual performance and not upon opinion or guess.

The factors affecting milling operations are chiefly as follows: The machine must have a motor, or motors, of sufficient size. The overloading of the motors on three machines emphasized this. Kent's Handbook states that from 2 to 2 1/2 H.P. is required to remove one cubic inch of alloy steel per minute. One milling machine manufacturer, using separate motors for driving the spindle and the table feed, allows 1 H.P. per cubic inch of steel removed per minute for the spindle motor.

Experience with milling machines having separate motors for the spindle and feed drives shows that it is important to avoid overloading of the spindle driving motor. Should it be overloaded so as to slow up the spindle speed, the chip thickness will increase, thus increasing the load on the cutter teeth and the spindle torque. If the feed motor does not stop, the cutter may break, the work may be pushed out of the fixture, or the fixture may be pushed off the table of the machine. A compromise figure of 1 1/2 H.P. per cubic inch of metal removed per minute was, therefore, adopted as a safe figure for all milling operations on steel. This gave satisfactory results.

The table feed should be so designed that, if necessary, "climb," or "down," milling cuts may be taken. Parts that require a deep milling cut, small rectangular parts, and thin or slender parts will, in many instances, be pulled out of the vise or fixture by milling cutters that rotate

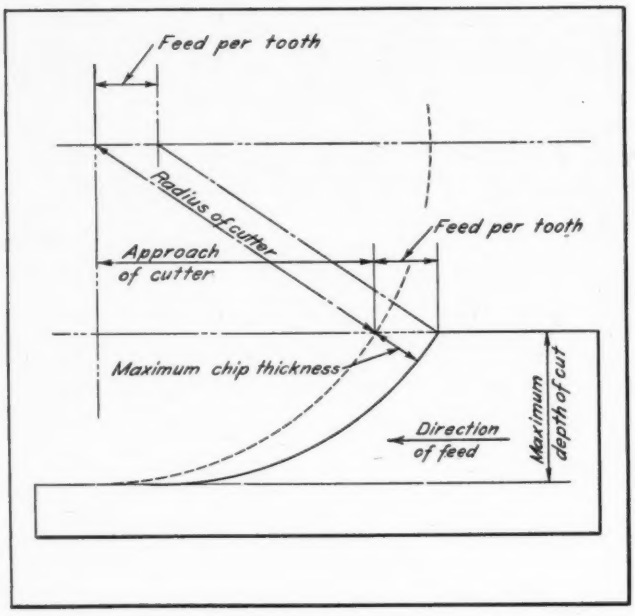


Fig. 1. Diagram Showing Relation of Feed per Tooth, Maximum Chip Thickness, Maximum Depth of Cut, and Radius and Approach of Cutter

in the conventional manner. In these cases, "climb," or "down," milling cuts should be used. Milling machines with tables driven by a rack and pinion were not found suitable for "climb" milling cuts.

The advance of the cutter on spline milling machines differs from that on the usual type. On the older models, the cutter is fed into the work continuously during both strokes of the table. On later machines, the cutter is fed into the work at each end of the table travel. The in-feed is in increments of 0.0025 to 0.0030 inch. It should be noted that the in-feed determines the depth of the cut and not the chip thickness per tooth. The table is actuated by a crank. Because of this construction, the maximum rate of travel of the work past the cutter takes place at the middle of the table travel. The maximum work travel is equal to the product of the stroke in inches multiplied by the revolutions of the crank (or the number of cycles of the table) per minute, multiplied by 3.14.

Other Conditions Necessary for High-Production Milling

The spindles must have a suitable range of speeds. It is sometimes necessary, because of the fixture dimensions, to use a large machine for end-milling operations with a small-diameter cutter. In that case, the required speed range may not be available. In one case, the transfer of a job from a machine with a limited range of spindle speeds to one having a higher range resulted in a satisfactory increase in the rate of feed of 125 per cent.

All of the milling machines used were equipped with coolant systems. The steel being milled had a tendency to weld to the faces of the milling cutter teeth, forming built-up edges. Coolants that reduced this tendency were selected.

The cutters must be properly sharpened. The most common cause of cutter breakage and scrap due to incorrect dimensions obtained on the milled work was found to be insufficient clearance at the periphery of the cutter teeth. On some cutters, the primary lands were cylindrical as a result of spinning the cutters on centers while sharpening them. On others, the lands were too wide or else did not have enough clearance. Lands that interfere with the work being milled cause excessive friction and heat, resulting in chatter, work-hardening of the milled part, and so-called "hard spots." Some special side milling cutters were found to have no side relief, and some had not been properly hardened.

The fixture must support the work rigidly. The body of the fixture must be able to take the thrust of the milling cut. The pressure exerted by the clamps should, whenever possible, co-act with the thrust of the cutter to hold the work firmly against the locating surfaces in the fixture. Whenever the thrust of the cutter is taken by the clamps, there is danger of the work-piece becoming loose in the fixture. The tightening of some commercial milling machine vises was found to spring the center of the vise base up from the surface of the machine table. The condition was similar to that existing when milling a part supported on a spring. The remedy was a bolt through the center of the vise base engaging a slot in the milling machine table.

Feed and Chip Thickness

Tables are available showing "permissible feed per tooth." The writer feels that the data in some of these, based on cuts of average depth, should more accurately be termed "advance" rather than feed per tooth. In the present case, it was decided to base the feeds for cutters used for roughing and semi-finishing milling operations on the calculated maximum thickness of chip per tooth. The reason for this was that similar cutters working under comparable conditions should be able to remove chips of the same thickness. Fig. 1 shows how the maximum thickness of chip was determined.

The radial lines represent the faces of two successive teeth in the milling cutter. The curved lines represent the paths of the two teeth through the work-piece. Although the paths are shown as arcs, they are actually trochoids.

The maximum chip thickness was calculated by the following rule, which was derived from the diagram by construction: The maximum chip thickness equals the feed, or advance, per tooth multiplied by the approach of the cutter,

the product being divided by the radius of the cutter (see Fig. 1 for nomenclature). Although this rule is not mathematically precise, the error is so small as to be of no practical significance.

Charts showing maximum chip thicknesses have been published, but are not always available to the time-study man. This rule makes it possible to use a specially prepared table of milling cutter approaches for calculating chip thicknesses.

The contour of many of the parts was irregular. The calculations, therefore, were always based on the maximum depth of cut, no matter where it was located in relation to the workpiece. In the case of plunge cuts, it is obvious that the maximum chip thickness is equal to the feed, or advance, per tooth. For spline milling operations, the feed, or advance, per tooth was based upon the maximum rate of travel of the work past the cutter. The method for calculating this rate of travel has already been explained.

The feeds for finish-milling cuts were based upon the feed per revolution of the cutter—that is, the spacing of the revolution marks. There is a mistaken idea as to the cause of revolution marks. Many think that they are caused by a high tooth. Actually, they are caused by a slight eccentricity of the periphery of the cutter about its axis of rotation. This produces a series of hills and valleys spaced a distance apart equal to the advance of the cutter during one revolution. Each valley is a curve generated by all or several of the teeth in the cutter.

An examination of the surface of a part milled by a steep spiral slab milling cutter will confirm this. The marks are at right angles to the path of the cutter. By counting the number of marks in 1 inch, the feed used at the time the part was milled can be calculated from the spindle speed employed. Milled surfaces with closely spaced revolution marks *appear* to be better finished than surfaces with widely spaced marks; but actually the finish is no better.

Form for Compiling Data for Typical Milling Operations

Fig. 2 shows the form that was used for compiling the data from typical milling operations. This form was run off on a mimeograph and punched for a three-ring binder. The men who compiled the data in the shop were trained to accurately observe and analyze the elements of an operation. They then filled in the required information on the form, made the necessary calculations, and recommended changes in speeds, feeds, machines, or fixtures, if this seemed advisable.

After the data and recommendations on the form shown in Fig. 2 were checked and approved, the essential items were typed on a form such as shown in Fig. 3. Copies of this form were routed as follows: The plant manager and the tool engineer each received a copy, and copies were also filed in binders in the superintendent's office, in the department performing the operation, and in the standards department.

The First Step in Determining Proper Speeds and Feeds

The data covering a number of operations were carefully analyzed before any recommend-

PART NAME._____ PART NO._____

OPER.NAME._____ OPER.NO._____

MATERIAL. _____ BRINELL._____

CUTTER TYPE._____NO.OF TEETH____ SPIRAL-STRAIGHT.

DIAMETER.____ROTATION, CONV.OR"UP.____CLIMB OR"DOWN.____

	PRESENT.	CHANGED TO.	SKETCH.
REV.PER MIN.	_____	_____	
SPEED,FT.PER MIN.	_____	_____	
FEED,IN.PER MIN.	_____	_____	
FEED,IN.PER REV.	_____	_____	
FEED,IN.PER TOOTH.	_____	_____	
MAX.CHIP THICKNESS.	_____	_____	

CUT,MAX.DEPTH IN. _____ WIDTH IN._____AREA,SQ.IN._____

CU.IN.PER MIN. _____ TIMES 1.5 EQUALS____HP.

MACHINE NAME._____MACHINE NO._____

CONDITION OF MILLING FIXTURE._____

_____

_____

_____

CONDITION OF CUTTER._____

_____

REMARKS._____

_____

_____

_____

BY._____DATE._____APPROVED._____

Use reverse side for additional remarks or sketches.

Fig. 2. Form Used for Recording Data Pertaining to Milling Operations

ations were issued to the shop. The data compiled from the first operations studied showed the method used to be correct. The variations in speeds and feeds employed for similar operations were found to be even greater than expected. Those operations where the speeds and feeds were exceptionally high were left undisturbed as a guide for future use. In some cases, the calculated maximum chip thicknesses were less than 0.0001 inch; very few were thicker than 0.0015 inch. The cutting speeds varied in ratios from 4 to 1.

As a result of this preliminary investigation, it was decided to establish the speeds and feeds for milling steel of from 200 to 230 Brinell hardness as follows: High-speed steel cutters were the only kind in use at this time. The cutting speed for operations performed on power-feed milling machines was from 70 to 75 feet per minute for roughing and semi-finishing cuts. For cuts where the amount milled off was less than 1/32 inch thick and for finish-milling cuts, a cutting speed of from 95 to 100 feet per minute was established.

On spline milling machines, the cutting speed was made from 125 to 130 feet per minute. The cutter on this type of machine mills away a layer of metal about 0.010 inch thick from the bottom of a slot or keyway; hence, the chip is very light.

The cutting speed of hand-fed milling machines (hand millers and profilers) was established at from 95 to 100 feet per minute. It is advantageous to run cutters on hand-fed machines at fairly high speeds in order to reduce the chip load per tooth and possible cutter breakage caused by strong-armed operators.

Establishing Power Feeds and Maximum Chip Thickness

Power feeds for roughing and semi-finishing cuts were based upon the calculated chip thickness per tooth:

End-mills 1/4 inch in diameter, milling slots 3/16 inch deep from the solid—0.0005 inch maximum chip thickness per tooth.

End-mills about 7/16 inch in diameter, milling slots 3/8 inch deep from the solid—from 0.00075 to 0.0010 inch maximum chip thickness per tooth.

End-mills on spline milling machines—0.010 to 0.015 inch maximum chip thickness per tooth. (This is based on the maximum rate of travel of the work past the cutter at the middle of the table travel.)

Plain milling cutters having straight teeth—0.0015 to 0.0020 inch maximum chip thickness per tooth.

Steep spiral slab milling cutters from 3 to 4 inches in diameter—0.0025 to 0.0030 inch maximum chip thickness per tooth.

Staggered-tooth cutters milling channels about 7/8 inch deep—0.0015 inch maximum chip thickness per tooth.

Side milling cutters for face-milling operations—from 0.0035 to 0.0040 inch maximum chip thickness per tooth.

The feeds for finish-milling cuts were based upon the spacing of the revolution marks. All cuts less than 1/32 inch in depth were arbitrarily classed as finishing cuts. The spacing of revolution marks was held within 0.020 to 0.035 inch—that is, the feed per revolution was held within these

PART NAME._____ PART NO._____

OPER.NAME._____ OPER.NO._____

CUTTER TYPE._____NO.OF TEETH___ SPIRAL-STRAIGHT.

DIAMETER.*____ROTATION, CONV.OR"UP".____CLIMB OR"DOWN".____

	PRESENT.	CHANGE TO.
REVOLUTIONS PER MIN.	_____	_____
FEED,INCHES PER MIN.	_____	*_____
FEED,INCHES PER REV.	_____	*_____

MACHINE NAME._____

MACHINE NO._____FIXTURE NO._____CUTTER NO._____

REMARKS:

MACHINE._____

*FIXTURE._____

BY._____DATE._____APPROVED._____

*The diameter of the cutter specified above is approximate. Be sure to use a cutter of the diameter shown on the tool drawing.

*Standards will be based upon the above feeds and speeds which are conservative.

Fig. 3. Instruction Sheet Relating to Milling Operations, Giving Feeds and Speeds

limits. This range was adopted in order to avoid sacrificing production on the larger diameter cutters. The feed is given approximately by the formula:

$$f = \frac{1}{\frac{25}{D} + 25}$$

in which f = feed, in inches per revolution; and D = diameter of cutter, in inches.

The following simple formulas are based on the above assumptions and a cutting speed of approximately 100 feet per minute. They are for finish-milling operations in which the periphery, not the end, of the cutter machines the surface.

$$\text{R.P.M.} = \frac{380}{D}$$

$$F = \frac{15.2}{1 + D}$$

In these formulas, R.P.M. = revolutions per minute of cutter; F = feed, in inches per minute; and D = diameter of cutter, in inches.

The last formula relating to feed shows why many recommendations were made to reduce the diameters of the cutters. Smaller diameter cutters save cutter materials, reduce the torque on the cutter-arbor, and make it possible to use higher rates of feed for finishing cuts.

When speeds and feeds were arbitrarily determined, care was taken to make them conservative, since they entered into time studies which were made the basis of a bonus system of wage payment. Some specific examples may prove of interest.

Examples of Application of the Methods Outlined

A feed of 1 inch per minute was being used for milling a groove approximately 1/4 inch wide by 3/16 inch deep from the solid. The highest spindle speed available was 575 R.P.M. In this type of cut, the maximum chip thickness is equal to the feed, or advance, per tooth of the cutter. The job was transferred to a machine where the cutter was run at 1200 R.P.M. The cutter had four teeth, the feed per tooth was set at 0.0005 inch, the permissible feed, in inches per minute, was calculated to be 2.4 inches. Actually, a feed of 2.25 inches was employed, which resulted in an increase of 125 per cent in the rate of feed, as compared with that used in the first machine.

In one case, a complaint about the short cutter life on a spline milling machine was received. The machine was used for milling a slot about 3 1/2 inches long. It was found that the maximum rate of advance of the work past the cutter at the middle of the table stroke was over 90 inches per minute. This was reduced to approximately 50 inches per minute, and no further difficulties were experienced. Generally, the maximum rate of table travel on spline milling operations was set between 28 and 32 inches per minute.

The set-up men had access to the speed and feed data issued to the departments in which they worked. They had sufficient time to try out the recommended speeds and feeds before the time-study man arrived to make his observations. The time-study man checked the revolutions per minute of the cutter-spindle and timed the travel of the table over a measured distance. It was sometimes found that there was a difference between the feed as indicated on the feed dial and the actual rate of feed of the table. For this reason, all feeds were timed over a measured distance. It should be noted that less than ten speeds and feeds had to be changed out of several hundred for which standards were set by the methods outlined.

* * *

How to Introduce Carbide Tools on New Operations

At a symposium on high-speed milling held at the recent annual meeting of the American Society of Mechanical Engineers in New York, Einar Almdale, service engineer of the Carboloy Company, made the following suggestions for the successful introduction of carbide tools on new applications: (1) Go slowly at first; do not tool up all machines at once with carbide tools. (2) Make the first series of applications of carbide milling cutters on a few simple surfaces, such as facing cuts. (3) Do not introduce carbides on difficult jobs until sufficient experience has been gained on the first simple applications. (4) Use a fly cutter—that is, a single-toothed cutter which can easily be altered and reground to suit any particular job—when establishing cutter specifications for a relatively complicated job.

By such a method, the author of the paper said, the following results may be expected: (1) The individual machine operator will gradually become accustomed to working at greatly increased speeds. He will have sufficient time to become acquainted with high production cutters. (2) The method provides a time interval in which the grinding-room personnel can acquire the proper technique for grinding carbide cutters, since it is highly important that they be ground and used correctly. (3) The simplicity of grinding and adjusting a fly cutter when used to establish cutter-tooth characteristics enables the engineer to obtain more quickly the required answers to questions concerning the correct rakes, tip thickness, feed per tooth, speeds, and grade of carbide most suitable.

Grinding Steel-Cutting Carbide Tools

Correct Methods of Grinding Carbide Tools for Cutting Steel will Greatly Prolong the Life of the Tools and Increase Cutting Efficiency, Thereby Reducing Costs

By W. L. KENNICOTT, Tool Engineer
Kennametal, Inc.

THE correct grinding of steel-cutting carbide tools is of prime importance. Improper grinding methods will produce weaknesses in carbide tips that are not inherent in the material. Cracks and checks are formed in the carbide which can be avoided by proper wet grinding when resharpening.

Dry grinding should be avoided whenever possible, particularly on tools larger than 5/8 inch square. If a number of tools can be ground at one time, it is possible to dry-grind each one for a brief period and lay it aside to cool while grinding the others; still a great deal of time is lost by this procedure, and frequently the need for immediate use of a particular tool causes it to be ground without sufficient cooling periods, resulting in cracking or checking of the tool. When cracked tools break down in the machine, the regrinding requires the removal of a considerable amount of metal, instead of the few thousandths inch of surface usually necessary in resharpening. The extra grinding ties up tool-grinding machines, creates additional heat in the tools, and thus further aggravates the conditions. Briefly, therefore, dry grinding is possible, but it is not usually practical.

In addition to eliminating tool damage from checking, wet grinding is faster than dry, permits the use of more durable wheels, and washes away the abrasive dust. Frequently, wet grinding makes finish-grinding on large roughing tools unnecessary, since 80- or 100-grit wheels, when grinding wet, produce a fine enough cutting edge for most jobs.

Procedure for Rough-Grinding Tools

Rapid grinding is possible on large green- or gray-grit, special loose-bond, silicon-carbide wheels, using a water coolant with enough sal

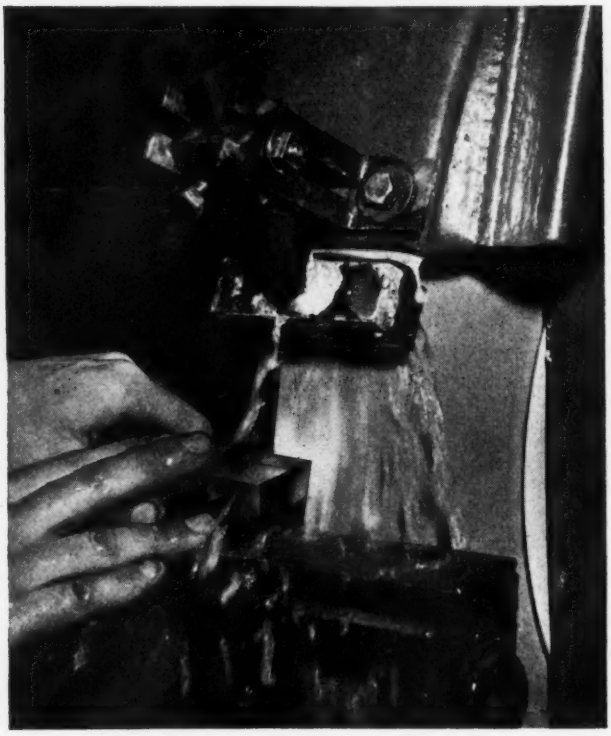


Fig. 1. Rough-grinding the Top of the Tool

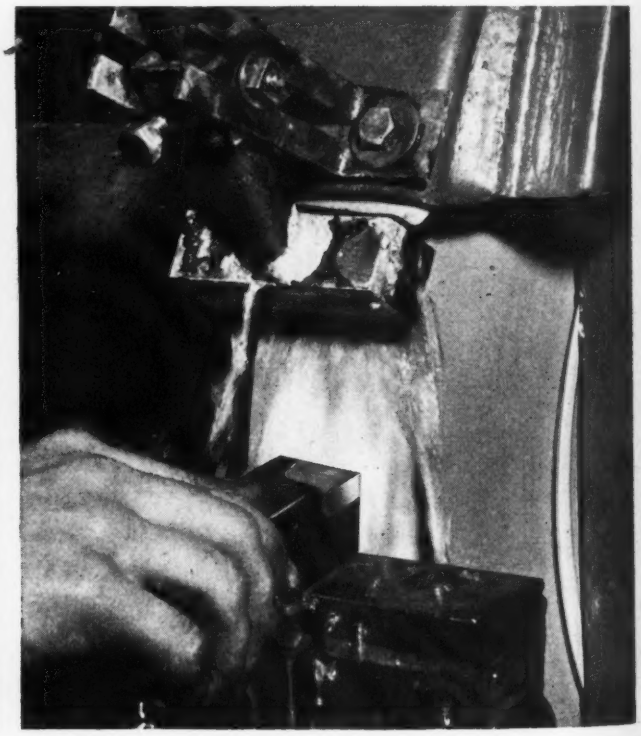


Fig. 2. Rough-grinding the End of the Tool

soda to make an alkaline solution and prevent rusting of the machine. A 60-grit, soft-bond wheel of as large a diameter as possible should be used. A 20-inch diameter straight-faced wheel is preferred for rough-grinding the usual run of large tools, such as are used in machining shells and other armament.

The coolant should cover the entire working face of the wheel and make contact with the wheel just above the tool. An ample flow should be provided, not a tiny jet or spray. A spur-wheel dresser should be used frequently to keep new silicon-carbide crystals exposed. An experienced operator can keep the wheel dressed by manipulating the tool being ground; he maintains a constant movement of the tool back and forth across the wheel, as well as rocking the tool in both directions.

Alternate light and heavy pressure is used to break the silicon-carbide crystals and thus maintain a sharp free-cutting wheel. The flow of coolant, the hardness of the wheel bond, and other grinding conditions should be such that the tool, pulled rapidly away from the wheel while grinding, should not feel warm when touched with the finger.

To permit rocking the tool in all directions during the roughing operation, a narrow tool-rest about 1 1/2 inches wide should be used. This rest may be set at an angle of from 2 to 3 degrees more than the clearance angle required, thus permitting a final pass over the wheel with the tool held on the rest to true up the angles for finish-grinding.

The Finish-Grinding Operation

For finish-grinding steel-cutting carbide tools, a large cup-wheel of between 90 and 120 grit, used on a wet grinder, is recommended. The tool should be kept moving back and forth across the wheel since the large tool-rest used to true up the angles does not permit of rocking the tool. Dressing the wheel with a 1/32-inch crown in the center of the face decreases the area of contact and permits better cooling of the tool. If the finishing must be done dry, the wheel must be kept sharp enough so that no heat coloring shows either on the tip or on the shank steel.

In finish-grinding, it is best to use the face of a cup-wheel, as indicated in Fig. 4. The top of the tip is ground first, the table rest being set at the finished rake angle desired. To grind the end of the tool, set the table rest at the finished front clearance angle desired. If the clearance on the tip is made from 2 to 4 degrees less than that on the shank, the wheel contact will be on the carbide tip only, reducing the grinding time and preventing the wheel from loading.

The grinding of the side clearance and side cutting edge angles is the last step in the finish-grinding of tools. As in rough-grinding, wet grinding is preferred. The tool radius is formed by rotating the tool from the side cutting edge to the end cutting edge, blending the radius tangent to the side and end cutting edges. Diamond-impregnated Bakelite wheels of 220 grit are recommended for finish-grinding. Honing sometimes will increase tool life on light cuts.

Fig. 3. Rough-grinding the Side of the Tool

Fig. 4. Finish-grinding the Top of the Tool

Grinding in Rigid Fixtures

When steel-cutting carbide tools are ground on a magnetic chuck or in a rigid fixture, resinoid-bonded diamond wheels are recommended. A light vertical feed per pass is advisable to insure long wheel life and freedom from checks in the tool. The diamond grit is harder than the carbide, and will cut it if passed across the carbide surface, but the wheel bond is much softer than the carbide, and must be protected by the projecting diamond particles. A 100-grit wheel has grains about 0.0045 to 0.005 inch mean diameter, which must be embedded at least three-fourths of that distance in the bonding matrix, leaving about 0.001 inch of cutting edge projecting.

Just as a tool with a tip 3/4 inch long would not be used on a cut 1 inch deep, a wheel with 0.001 inch maximum cutting edge length should not be used on a depth of cut over 0.0005 inch, if allowance is made for some wear of the diamond grains. Fortunately, diamond wheels cut carbide readily at high table speeds, so that the combination of 0.0005 inch feed per pass with a rapid table motion results in fast grinding.

Incorrect Grinding Weakens Tools

Breakdown of a crazed tool (a tool having fine cracks) usually occurs while it is cutting; it sometimes appears to have broken from too high a cutting pressure. Since this type of crack seldom can be seen, even under fairly high magnification, and since breakage occurs while the machine is being operated, even the most experienced men often fail to give the correct reason for the tool breakdown. Several things may cause tool breakage:

The crazing and subsequent weakening of a tip surface may be caused by suddenly overheating the tip surface while the interior remains cool. Checking or crazing may, therefore, be caused through the use of an alundum-carbide wheel of too hard a bond or a low-concentration diamond wheel. A tool crazed on the broad top surface of the tip will sometimes lose a section back of the cutting edge, where there is apparently no strain.

The second, larger type of crack is caused by the difference in expansion of the steel shank and the tip, and usually appears parallel to a brazed surface or near it. This crack generally is caused while snagging away the shank steel below the tip. When a tool shank becomes blue from the heat of grinding, there is probably a crack in the tip, although it may not show until the tool is in use. This type of crack can also be caused by too rapid cooling of the tool after grinding or by an interrupted flow of coolant while cutting.

Grinding with diamond wheels should be restricted to the carbide part of the tool as far as possible, as the comparatively soft steel shank loads up the wheel, necessitating frequent dressing and causing rapid wheel wear. On the other hand, a good grade of diamond wheel, properly used in grinding carbide tools, has a long life.

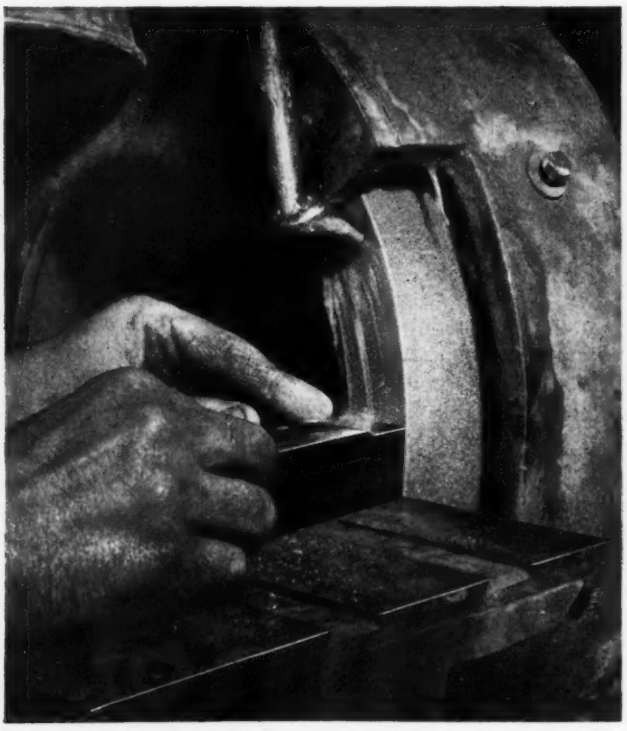


Fig. 5. Finish-grinding the End of the Tool

Fig. 6. Finish-grinding the Side of the Tool

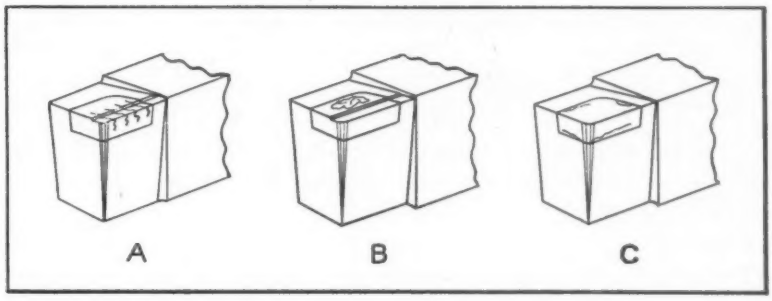


Fig. 7. Types of Tool Failures—A, Vertical Checking; B, Surface Crazing; C, Parallel Checking

Steel-cutting cemented carbides have approximately half the thermal expansion rate of the steel shanks to which they are brazed. This creates large strains in the carbide when both tips and shanks are heated equally; and when the steel is being roughed away under the tip, the condition is accentuated, because the steel is at a higher temperature than the carbide.

Steel-cutting cemented carbides also have a lower heat conductivity than cast-iron cutting grades. In cutting, this is an advantage, as it throws the heat into the steel chips; but during grinding, care must be taken to avoid overheating an edge or surface when the rest of the carbide tip is cooler. Localized heating tends to tear the overheated surface away from the mass of the carbide, causing a network of fine hairline cracks or checks.

The best way to prevent either of the above types of thermal expansion strains is to keep the surface being ground cool at all times by the use of an adequate flow of coolant on the tool and wheel. The flow must be adequate, however. A dry grinder is not desirable, but a "damp" grinder is still more objectionable.

How to Avoid Cracks and Checks

The following grinding instructions will aid in obtaining full life from steel-cutting carbide tools: (1) Always wet-grind the tools at from 4300 to 5500 surface feet per minute. (2) Use a 60-grit, silicon-carbide, soft-bond wheel for roughing, and a 90- to 120-grit wheel for finishing. (3) Keep the wheels dressed with a star dresser. (4) Use sufficient coolant with a full, steady flow. (5) Move the tool back and forth across the wheel constantly. (6) Use resinoid-bonded diamond wheels when grinding in a rigid fixture or magnetic chuck.

Cutting Tool Manufacturers Association Organized

ARTICLES of incorporation of the Cutting Tool Manufacturers Association have been filed in Wilmington, Del. W. G. Robbins, president of the Carboloy Company, Inc., Detroit, Mich., has been elected chairman of the board of directors. Other members of the board so far elected are: Oscar L. Bard, president, Michigan Tool Co., Detroit; George L. Buffington, superintendent of estimating and process engineering, Ex-Cell-O Corporation, Detroit; E. A. Goddard, vice-president, Goddard & Goddard Co., Detroit; Norman Lawton, partner, Star Cutter Co., Detroit; R. G. Michell, president, Eclipse Counterbore Co., Detroit; E. C. Putnam, president, Putnam Tool Co., Detroit; R. M. Severance, president, Severance Industries, Inc., Saginaw, Mich.; and R. H. Wolfe, president, Arrow Tool & Reamer Co., Detroit. Additional directors will be elected from other sections of the country.

The by-laws adopted provide that membership is available to any individual, partnership, firm, or corporation engaged in the manufacture of tools designed for cutting materials through the use of power-driven machinery. Manufacturers of hand-operated cutting tools are not included. Each company member may appoint one or more individuals to represent it.

The Association will render assistance not only to the cutting tool industry, but also to federal and local agencies on such subjects as renegotiation, taxes, contract cancellation and termination, disposal of surplus cutting tools by the armed services, standardization of cutting tools, and post-war disposal of emergency manufacturing facilities.

* * *

What is said to be the world's fastest industrial motor, operating at 1000 revolutions per second (60,000 R.P.M.) has been designed by an engineer of the Westinghouse research laboratories. The new motor is intended for driving high-speed grinders used to produce a mirror-like finish on internal surfaces of plane and tank engines. Another motor is now being designed that will revolve at twice this speed.

Self-Centering Bobbin Spindle

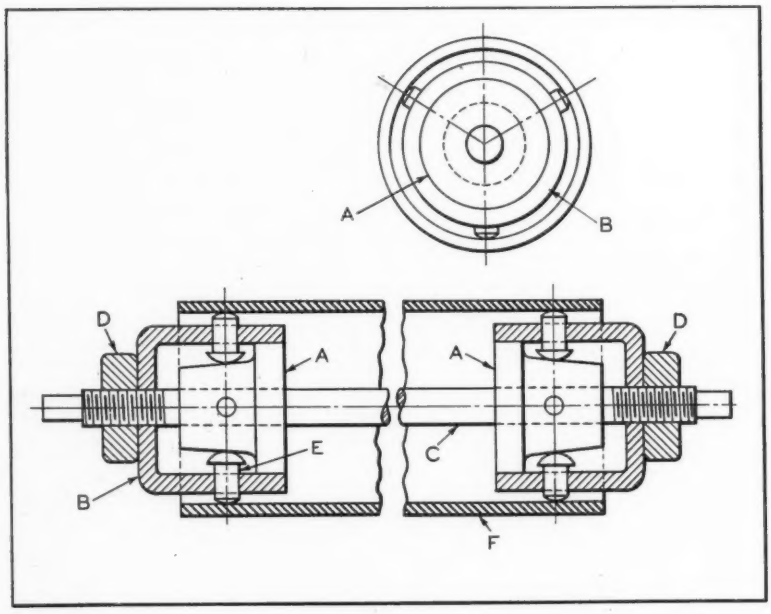
By HAROLD E. MURPHEY

The accompanying illustration shows a quick-acting self-centering bobbin spindle for use on textile machines. It is designed to permit empty or full Bakelite bobbins to be quickly mounted on or removed from the machine. This spindle can be made at very low cost, as the equalizing heads *A* and adjusting sleeves *B* can be made from hard wood, such as maple. The spindle *C* and nuts *D* are of steel, and commercial round-head rivets can be used for pins *E*. The heads *A* are pinned to the spindle as indicated.

The heads are tapered, so that when a full or an empty bobbin *F*, as the case may be, is placed on the spindle, all that is necessary to hold the bobbin in position is a slight turn of the adjusting nuts *D*, which pushes the adjusting sleeves inward, thus expanding or forcing the pins *E* outward so that they grip the inside of the bobbin and hold it in position. The equalizing pin design is necessary because the Bakelite bobbins are not machined.

An equalizing or self-centering spindle of the design shown can also be used for turning or grinding steel tubing on the outer surface; but since the pressure on the pins would have to be considerably greater in the case of metal tubing, it would be advisable for such an application to make all the parts of steel, and thus eliminate undue wear.

Only a slight pressure is required on nuts *D* to hold the bobbin in position; thus there is very little strain on the pins. The ends of the spindle revolve freely in bearings. Rotation of the bobbin is accomplished merely by the pull on the thread as it is removed from one bobbin by rewinding on another.



Self-centering Bobbin Spindle that Permits Quick Changing of Bakelite Bobbin F

* * *

Conservation of Paper an Urgent Need

Because of the extreme demand for paper due to the war effort and the reduced supply of paper due to lack of man-power and paper-manufacturing facilities, manufacturers and the public are being urged to do everything in their power to conserve paper and paper products. The war industries have placed an unusually heavy demand on the paper manufacturer because of the tremendous additional use in drawings and blueprints alone.

It is difficult to realize that it takes 25 tons of blueprint paper to prepare for the building of a battleship, or that there are 700,000 different items that are shipped by the Army, paper-wrapped or paper-boxed. The shipping of each Signal Corps radio set requires 7 pounds of kraft paper and 3 pounds of book paper. A 500-pound bomb requires 12 pounds of paper for rings, tops and bottoms; and a fiber container for a 75-millimeter shell requires 1.8 pounds of paper board. These are but a few of the uses of paper in the manufacture of war equipment.

In order to make the available paper supply sufficient for the Army's need and for important civilian needs, manufacturers are urged to do everything in their power to reduce the use of paper around manufacturing plants and in containers for goods being shipped. The Office of War Information and the War Production Board in cooperation have published a bulletin entitled "Paper Packs a War Punch," which can be obtained from the Office of War Information, Washington, D. C.

* * *

Annual Meeting of Society of Automotive Engineers

The annual meeting of the Society of Automotive Engineers was held at the Book-Cadillac Hotel, Detroit, Mich., January 10 to 14. Numerous sessions were held relating to various phases of automotive production, including aircraft engines; passenger cars, trucks, and buses; Diesel engines; fuels and lubricants; transportation and maintenance; and materials. A production session dealt with "Getting a Better Grip on Quality Control."

Engineering News

"Silentbloc"—A New Vibration-Absorption Method

A new method of vibration absorption has been developed by the General Tire & Rubber Co., Akron, Ohio, under the trade name "Silentbloc." This method makes use of rubber and steel, and is said to eliminate the uncertainties of the bonding process of holding rubber to metal by forcing rubber at high speed between two pieces of metal. The live rubber, held in position by the metal, strives to regain its original shape, and the pressure exerted by this action assures a permanent bonding. It is expected that after the war "Silentbloc" will find many uses in peacetime industries, especially for automobiles, engine mountings, rolling mills, textile machinery, washing machines, printing machines, etc.

Most Powerful Electric Motor Ever Built

What is said to be the most powerful electric motor in the world has just been completed by the General Electric Co. at Schenectady, N. Y., for shipment to the new Geneva steel mill in Utah. By applying 7000 H.P. at the comparatively low shaft speed of 25 R.P.M., this giant direct-current motor develops greater torque than any other motor, either alternating or direct current, ever built. It will operate the reversing rougher of a plate mill which produces steel plates for shipyards and other war industries from slabs weighing as much as 20,000 pounds. The maximum turning power of the motor, which is 2.75 times the rated 7000 H.P., is more than 4,000,000 foot-pounds.

Lucite Housings for Marine-Engine Filter Units

Housings for marine-engine water filters on naval and merchant ships are now being made of Lucite, a methyl-methacrylate plastic manufactured by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. These filters strain solid matter from circulating water, preventing the cooling system of the engine from clogging and overheating. Twin filters in separate housings are installed to provide continuous operation should one filter become clogged. The strong, transparent plastic used for the housings permits a continuous view of the filtering, and has greatly reduced the breakage problem encountered with other transparent materials. The housings are 6 inches outside diameter, 8 to 12 inches long, with a wall thickness of 1/4 inch.

"Portable" 5000-K.W. Power Plant for Use Anywhere in the World

A complete 5000-K.W. "portable" central station has been designed by the Westinghouse Electric & Mfg. Co. This power plant is portable in the sense that, when completely assembled, it makes a railroad train of eight cars. This power train can be used in almost any part of the world. It has been designed to use coal of low quality, and is also suitable for regions where water may be scarce or may have to be delivered in tank cars. It will work at temperatures of from 110 degrees F. above to 40 degrees F. below zero. This rolling power plant can be hauled by a locomotive to any spot where there is a railway track, and in about forty-eight hours it can be made ready to deliver power.

Low-Cost Metal Spray Prolongs Life of Wood Patterns and Core-Boxes

The life of wooden patterns and core-boxes can be prolonged by spraying the surfaces with a light coating of metal. Equipment for this purpose has been developed by the Alloy-Sprayer Co., 2040 Book Bldg., Detroit, Mich. If the surface of the wood is relatively soft or open-grained, the metal can be sprayed directly on the finished surface without special preparation. If the wood is hard and close-grained, a coating of shellac is applied and the spraying is done while the shellac is "tacky." In either case, the thickness of the metal coating is usually from 0.002 to 0.005 inch.

After the coating is sprayed on the wood surface, it is allowed to cool thoroughly, and is then sanded down to the finish desired. Worn areas in used patterns can be coated, and holes filled up in a similar manner, by merely applying a thicker coating of metal. The type of metal employed has been especially developed for such protective coatings. It is a low-cost alloy with a low melting point, and has a relatively hard surface when finished.

Editorial Comment

Some of our daily newspapers, usually fair-minded in their attitude toward the problems of industry and business, have recently voiced certain opinions on the subject of renegotiation that indicate that the issues involved are not fully understood.

A great deal has been said about renegotiation that is not so. Some men occupying high places in Washington have made statements that have not expressed the whole truth. It may, therefore, be worth while to set forth briefly some of the underlying facts and principles.

The True Facts about Renegotiation Should be Stated

It is obvious that no one should be permitted to get exorbitant returns from the war effort; and that applies to manufacturers and workers alike. About this there can be no argument. The great majority of industrial executives and business men agree with that principle.

As a matter of fact, most industrial owners and managers of businesses that are going concerns in peacetime as well as in wartime have considerably less left in the form of expendable income now than they had in normal peace years, simply because their nominal income is so sharply reduced by present income taxes. This, too, they recognize as right and proper, because they are just as willing as any other group of people in the nation to do their share in contributing to the war effort.

Actually, in that respect, our manufacturers have shown an even greater willingness to sacrifice than some other groups—notably some labor leaders who have been willing to jeopardize the war effort through strikes, in order to secure increased financial benefits for their groups. Hence, the charge that all industrial leaders and business men are profiteers is as unfair as it is untrue.

Of course, there are a few—but, by comparison, a very few—who are exceptions; but because there are such exceptions, this does not change the main facts in the case. There are always a few rotten apples, even on the finest tree; but that is no justification for cutting down the tree.

Those who have not acquainted themselves with the methods used by our Government agencies in handling renegotiation cases cannot possibly understand what is involved. Briefly, we have created an arbitrary power within the Government that, without due process of law—that is, without supervision of duly established courts—can assess payments against a manufacturer, whether they be fair or not. He has no choice but to pay. There is no uniformity in making these assessments; there are no basic rules by which a manufacturer can figure for himself what he will be asked to refund. The amount is arbitrarily determined, and no recourse can be had to the courts. This is the chief objection to the whole procedure.

Perhaps the most widely ignored fact pertaining to renegotiation is that the money recovered by the Government is by no means a net saving to the nation, because, under our present tax laws, up to 90 per cent of any excess profits is recovered without the complexities and additional expenses involved in renegotiation proceedings.

The Under Secretary of War has stated that the Government has recovered $5,000,000,000 through renegotiation of war contracts. Had there been no renegotiation law, our regular tax laws would have brought in about 80 per cent of this; and of the remaining 20 per cent, a considerable proportion is lost because of the heavy cost of renegotiation proceedings to the Federal Government and to the industrial concern that is put through the renegotiation wringer. The smaller concerns suffer proportionately more than the larger firms because their financial set-up usually is not adjusted to the heavy demands placed on them.

Amounts Recovered are Not Net Savings as Represented

Furthermore, war production suffers because the attention of many important industrial executives is diverted for a considerable period of time from the problems pertaining directly to war production to those of gathering and correlating information to be placed before renegotiation committees.

Surely, there must be some better and more equitable way to prevent profiteering in war contracts than a scheme whereby the Government arbitrarily fixes the price it wishes to pay *after* the manufacturer has delivered the goods.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Variable Reciprocating Motion

By L. KASPER

A reciprocating mechanism employed on a wire fabricating machine to convert a uniform motion into a variable motion is shown diagrammatically in Figs. 1 and 2. The reciprocating motion was required to meet conditions of operation resulting from a change in the design of a certain part of the machine. Originally, the reciprocating slide, traversing a stationary part of the machine, was given a uniform motion, coming to rest at a predetermined point.

Owing to the change in the part referred to, which reduced the clearance space available, it became necessary to retard the movement of the slide during a portion of its travel without changing the relative time at which the slide reached its ultimate position. This was accomplished by dividing the slide into two parts *A* and *B*, and introducing the levers *C* and *D*.

Referring to Fig. 1, slides *A* and *B* are dovetailed into a stationary part of the machine. Slide *B*, which is given a uniform reciprocating motion, carries the roller *F* which contacts with lever *D*, mounted on a fulcrum stud at the left. Slide *A* carries the roller *E*, which contacts with lever *C* mounted on the fulcrum stud to the right. Levers *C* and *D* are in contact at one point of their convex edges.

As slide *B* moves in the direction indicated by the arrow, its motion is transmitted through roller *F* to lever *D*, which is caused to pivot on its fulcrum stud. The motion of lever *D* is transmitted to slide *A* through lever *C* and roller *E*. It will be noted that *D* acts as a second-class lever on the end of lever *C*, which, in turn, acts

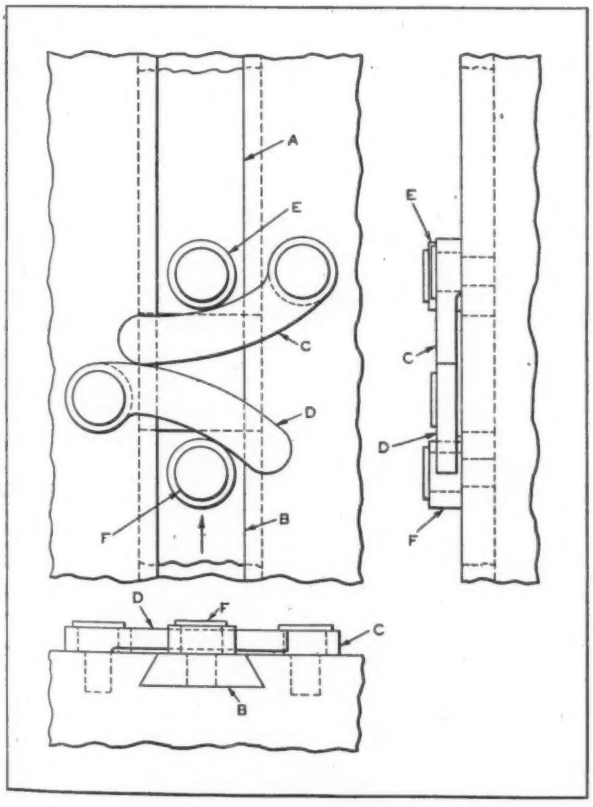


Fig. 1. Mechanism for Producing a Variable Reciprocating Motion

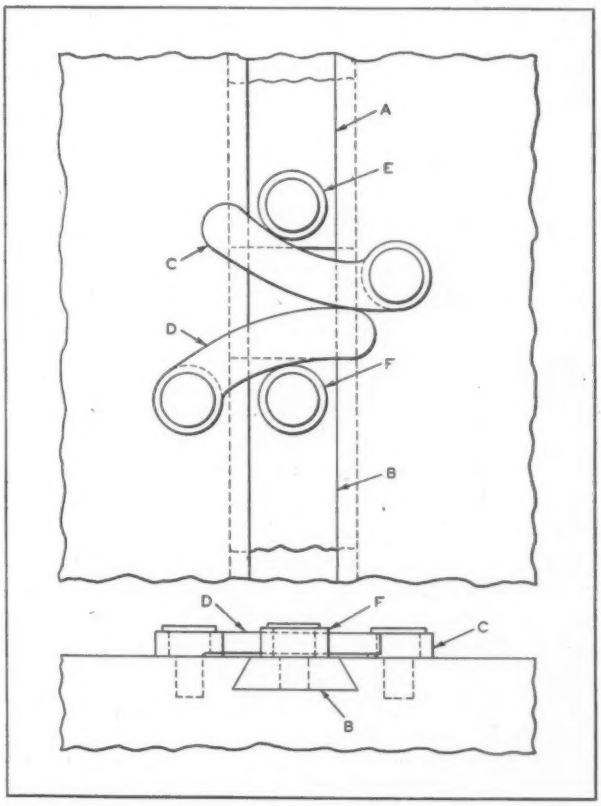
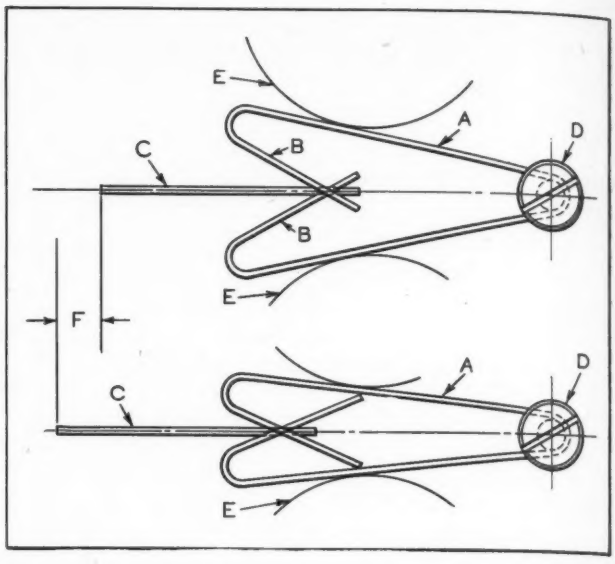


Fig. 2. Mechanism Shown in Fig. 1 with Slide near Upper End of Stroke

as a second-class lever on roller *E*. Since it is a characteristic of the second-class lever to transmit the motion of the power member to the working point at a reduced speed and length of travel, it is obvious that slide *A*, at this point, is moving more slowly than slide *B*, thus providing the required clearance at the far end of the slide *A*.

As continued movement of slide *B* causes levers *C* and *D* to change their relative positions, the lengths of the lever arms are constantly changing, so that slide *A* is given an accelerated motion which, however, is less than the movement of slide *B*. As levers *C* and *D* change their relative positions, they eventually arrive in positions in which the contact points between rollers *E* and *F* and the levers lie on the same straight line. At this point, slide *A* is momentarily traveling at the same speed as slide *B*, since the motion is transmitted by direct contact, there being no lever action at this point. Further movement of slide *B* results in a continued acceleration of the speed of slide *A*, which is then moving faster than slide *B*. This is due to the fact, as shown in Fig. 2, that *C* and *D* are acting as third-class levers.

It will be noted that there is no change in the relative positions of slides *A* and *B* at the two extreme positions, indicating that the length of travel of slide *A* is equal to that of slide *B*. The ultimate effect of this arrangement is that of a continuous slide, with the added advantage of a retarded movement at the point where clearance space is required. Slides *A* and *B* are returned to their original positions by a spring (not shown).



Simple Method of Producing a Reciprocating Motion for a Chart Recording Pen

Simple Reciprocating Mechanism for Chart Recording Pen

By JOSEPH WAITKUS

A very simple means for producing reciprocating motion was discovered recently while developing a special instrument. Aside from the simplicity of the device, which is shown in the accompanying illustration, there is the desirable feature of lightness, with a minimum amount of power loss due to friction.

The mechanism consists of a cam *A*, fabricated from spring wire. The two legs *B* of the spring cam cross and pass through a hole in bar *C*, while screw *D* serves to hold the spring cam in place in the instrument case.

Cams *E*, acting on spring cam *A*, cause the position of the point where legs *B* cross to change as cam *A* is depressed and released. In changing the position of the crossing point, bar *C* is made to move back and forth. The upper view of the illustration shows the device at the starting position, with spring cam *A* completely relaxed, while the lower view shows the relative position of the members of the mechanism when the maximum depression of spring cam *A* has been accomplished to displace bar *C* a distance equal to *F*.

Bar *C* is intended to support a pen for marking a continuous chart, and it is for this reason that lightness and easy operation are desired. The two cams *E* are not of the full rotating type. The motion of the cams about their pivots or centers is dependent upon the action of a bellows that is subject to pressure pulsations.

* * *

Standards Adopted for Machine Tool Parts

The American Standards Association has recently adopted standards for several different machine tool elements. One of these standards, designated B5.2–1943, relates to tool shanks and toolposts; another—B5.18–1943—covers spindle noses and arbors for milling machines. The National Machine Tool Builders' Association, the Society of Automotive Engineers, and the American Society of Mechanical Engineers are joint sponsors for these standards.

In order that these standards may be used as soon as possible in the everyday work of industry, it is suggested that manufacturers incorporate them in the specifications used in their shop practice and in their buying requirements, and also bring them to the attention of other manufacturers and suppliers. A concerted effort of this kind will do much to bring about general acceptance of these standards and thereby promote efficiency and reduce costs.

How to Secure Fine Surfaces by Grinding

By the Late H. J. WILLS
and H. J. INGRAM, Engineer
The Carborundum Co., Niagara Falls, N. Y.

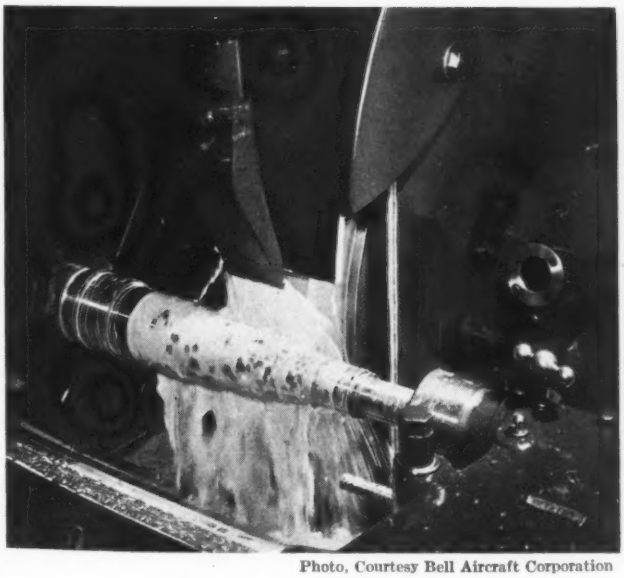
Ninth of a Series of Articles Describing the Factors that Govern Fine Surface Quality and the Means by which This Quality Can be Obtained—The Present Article Discusses the Subject of Coolants

METHODS and equipment employed in balancing grinding wheels to obtain accurately ground surfaces of fine quality were described in the preceding article of this series. The present article explains the important functions of coolants employed in grinding, and gives the properties of different types of coolants. It also explains how the coolants can be most effectively employed.

Fine grinding requires a copious supply of correctly selected coolant, directed at the point of contact between the work and the grinding wheel, as shown in Fig. 1. If the work is permitted to become too hot, it will be burned and must then be scrapped. Even a moderate rise in temperature, insufficient to cause burning, is likely to cause distortion of the work and result in out-of-roundness or other inaccuracies in dimensions. The expansion of the work radially may cause it to "bulge" toward the wheel, and the axial expansion may cause it to press so hard against the centers that the work will be bent or "bowed."

It is important to keep the work at a uniform temperature throughout the grinding operation —preferably at about room temperature. The ideal condition is to keep the work at the temperature at which it will later operate. If the grinding temperature is much above the operating temperature, the work is likely to be ground a few ten-thousandths inch under size, and vice versa.

Another important function of the coolant in fine grinding work is the protection of the work surface from scratches and similar blemishes by washing away atmospheric dust, chips of metal, and particles of abrasive and bond material which have been torn from the grinding wheel. Thus, the coolant is depended upon to keep the wheel face clean enough for proper cutting.



Photo, Courtesy Bell Aircraft Corporation

Fig. 1. A Copious Supply of Correctly Selected Coolant, Directed at Point of Contact between Work and Grinding Wheel, is Necessary to Produce Fine Surfaces

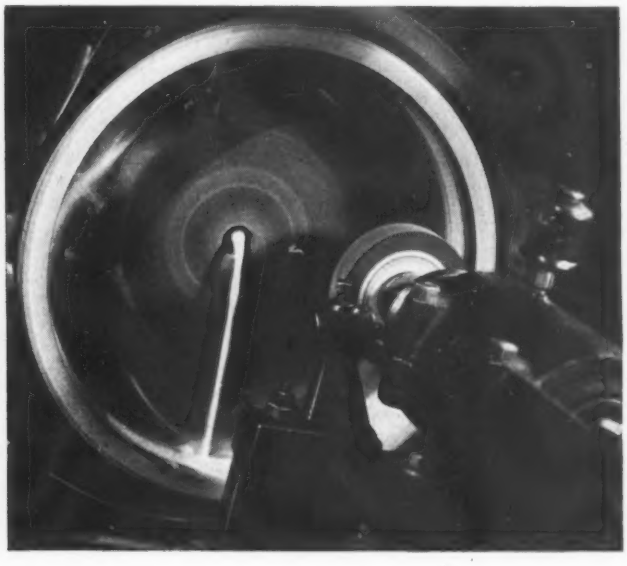


Fig. 2. Internal Grinding Operation in which Coolant is Brought to the Surface being Ground by Pipe that Passes through Center of Work-holding Spindle

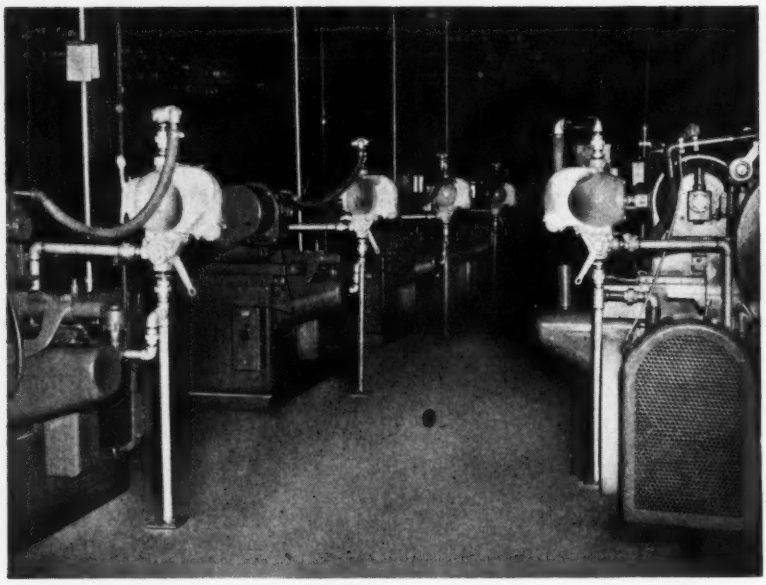


Fig. 3. Battery of Grinding Machines in which Each Machine is Equipped with Individual Fostoria Filter

Characteristics of Ideal Coolant for Fine Grinding

Since the primary purpose of a coolant is to keep the work cool, it should absorb heat readily —that is, it should have high specific heat. To cool the work properly, it must be easy for the coolant to get to the point of contact between work and wheel. The ability to do this depends partly upon the viscosity of the coolant, often called its ability to "wet out."

If particles of metal, abrasive, and bond are carried back to the point of contact of wheel and work by the coolant, surface defects will result. It is customary to let the coolant stand for a while in a settling tank to precipitate the foreign matter, or, at least, the major part of it. The lower the surface tension of the coolant, the more rapid and thorough will be the precipitation, and the less filtering will be needed. A certain amount of filtering, however, is practically always necessary in fine grinding.

The Coolant Should Contain a Rust Inhibitor

The coolant should contain a rust inhibitor to protect the work and the machine. This should not evaporate rapidly, but should remain on the work to protect it after the grinding operation. The coolant should have sufficient detergent properties to keep the wheel face in the condition required to produce the surface qualities desired. For the rough-grinding operation, which may precede finish-grinding, the coolant may be strongly detergent in order to keep the wheel face free from loading, glazing, and gumminess. In that condition, the wheel face will stay sharp and free-cutting and remove material rapidly without the use of excessive pressure, which would cause burning of the work and place a considerable strain upon the grinding machine.

However, the finish will be too rough for "fine" grinding. Therefore, a coolant should be chosen which will permit a certain amount of glazing in the finish cut to slow up the cutting action, but it should not be so weak in detergent action as to require excessive dressing, which will result in a great waste of abrasive, and consequently high wheel cost.

Obviously, when a single wheel is used for both the roughing and finishing grind, a compromise must be reached as to the detergent qualities of the coolant, since either the rate of cut or the finish will suffer. If fine quality surfaces are required, it is necessary to sacrifice the cutting rate and be satisfied with slower production.

In fine grinding to close tolerances, it is essential that the workman be able to see the point of contact between wheel and work. When opaque coolants are used, he cannot do this, and poor work is likely to result. Opaque coolants are often responsible for the very common mistake of shutting off the coolant flow as the wheel is brought to the work. This practice should never be permitted, for it is likely to result in a surface damaged by heat. Coolants should be as transparent as possible.

The bond of vitrified wheels is unaffected by any kind of coolant, but rubber bonds deteriorate under the action of some of the oils used in coolants. Alkaline coolants cause deterioration in resinoid, shellac, and silicate bonds. However, these coolants need not be entirely avoided in using wheels of this kind, but care should be taken to see that the solutions are not too strong.

Coolants Should be Chemically Stable

A coolant should be chemically stable, so that it will not become rancid nor decompose. When this happens, the odor is often so bad as to have an adverse effect on production. Also, such a coolant is a great breeding ground for bacteria, which may cause serious skin infections. A bactericide, recommended by the factory doctor or the local board of health, should be added to all coolants. The coolant should contain a substance that will prevent foaming or cause the foam to break down quickly, otherwise it will leak away and be wasted.

Any coolant substance, such as a paste, that

is mixed with water should mix easily and quickly to prevent waste of time. There should be no inflammable substance in the coolant. The following coolants are suitable for fine grinding. Water, besides being low in cost, is in many respects an ideal coolant. Because of its high specific heat, it dissipates heat rapidly. It is transparent, but it has the disadvantage that when used by itself it rusts the work and the machine. Because of its high surface tension, it does not precipitate suspended matter readily in a settling tank.

If sal soda is dissolved in plain water, a coolant results which is transparent enough, inhibits rust to a degree, precipitates particles of metal, abrasive, and bond, keeps the wheel face free-cutting, and removes oil from the work which might otherwise be carried to the grinding wheel, with bad results.

The principal fault of soda solutions is that they attack resinoid and shellac bonded wheels, causing the bond to break down. They may also affect the paint on the machine and cause skin and eye troubles.

Soluble Oil Coolants

Soluble oils are of several kinds—either soda- or potash-base, animal- or vegetable-base, or petroleum-base oils that have been cut with oils containing no acid or gumming materials. They protect against rust, dissolve easily in water, and give a fairly fine surface.

Few of the soluble oil coolants are transparent enough for fine grinding. They do not absorb and dissipate heat well, and unless thoroughly filtered, they gum up the wheel and work, and so require heavy pressures. Even so, they do not permit the wheel to be free-cutting. They also tend to disintegrate rubber-bonded wheels, thicken when cold, and when filtered, clog the filters.

Similar, both as to advantages and disadvantages, are the various grease and paste compounds. In addition, they are difficult to mix with water, requiring prolonged mixing with hot water in order to produce an emulsion that is suitable for grinding.

Soap Solution Coolants and Mineral Oils

Soap solutions are among the best of coolants for fine grinding, as they give fine finishes at fairly rapid cutting rates. They are neither too strong nor too weak in their detergent action. However, many soaps foam, break down mechanically, tend to become rancid and slimy, and because they precipitate poorly, have a tendency to carry chips and dirt to the point of contact. There are some high soap compounds which combine the good qualities of this type of coolant with comparative freedom from their worst faults.

Mineral seal oils, kerosene, and other similar oils are advocated by some for fine grinding. While they are excellent in thread grinding, it is our experience that they are not suitable for most fine grinding operations, except when the work material is aluminum. They do not absorb and dissipate heat well, tend to clog the wheel pores, present a fire hazard, and often have a bad effect on the operator's skin.

Advantages of Filters and Settling Tanks for Coolant Systems

It is strongly recommended that all coolant systems be equipped with filters, as well as settling tanks. For anything approaching fine grinding, it is essential that every bit of foreign matter be removed from the coolant before it returns to the work. Aside from the effect on the finish, filtering conserves the coolant, protects closely fitted high-pressure coolant pumps from wear due to abrasion, and reduces the need for frequent redressing of the wheel. When adequate filters are installed, it is not unusual to eliminate all rejections due to surface faults caused by foreign matter in the coolant. In some cases, the number of passes per wheel dressing has been doubled after the installation of a filter. Many shops report wheel dressings reduced as much as 10 and even 40 per cent.

Increases in production due to the freer cut-

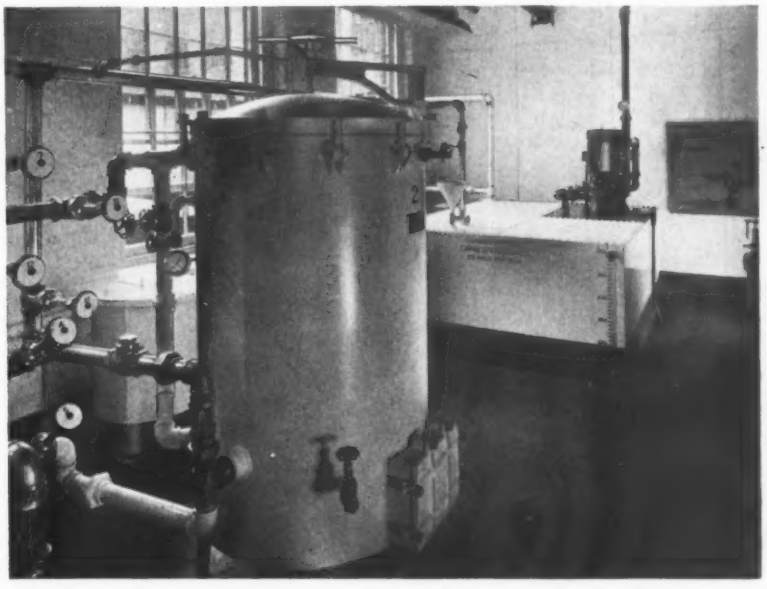


Fig. 4. Central Station Settling Tanks and Filters Designed to Supply Group of Grinding Machines with Clean Coolant

ting action of a clean coolant generally range as high as 40 per cent, and an increase of as much as 50 per cent is not uncommon. It is possible to install individual filters at each machine, as shown in Fig. 3, or to have a "central station" settling and filtering system like that shown in Fig. 4, or groups of settling and filtering systems, as shown in Fig. 5. The central system is often less expensive to install. It has the advantage of relieving the grinding machine operator from all responsibility for the system.

The big disadvantage is that different jobs call for different coolants. If all the machines are connected to a central station, it is not possible to suit the coolant to the job. This means that for some jobs it is necessary to use a poorly adapted coolant. Furthermore, there is danger of an infection being spread from man to man. The writer once saw an entire grinding department shut down because every grinding operator had been infected through the central coolant system with a very serious disease. Of course, the addition of an antiseptic to the coolant will minimize this risk, but with some diseases such preventive methods are of little use.

The advantages of the individual filter—one to each machine—are obvious. The best coolant can be selected for each job. Also, there is little chance of an infection spreading through the entire department.

When especially low temperatures are desirable in a grinding operation, it is possible to lower the temperature of the coolant by refrigeration. In some jobs, the coolant temperature may run as high as 200 degrees F. Somewhere around 100 to 110 degrees is high enough, since higher temperatures will cause the operator discomfort. For great accuracy and fine finish, it is possible to keep the coolant temperature as low as 70 degrees F.

Refrigerating the coolant also increases the accuracy and convenience of gaging, reduces skin infections, and permits the working of the coolant at a fixed viscosity.

It is poor economy to try to reduce the amount of coolant used. A copious flow should be provided at all times. Insufficient coolant is always ineffective, and is sometimes seriously detrimental to fine grinding.

It is occasionally difficult to get sufficient coolant at the point of contact between wheel and work, because the rapidly revolving wheel carries along with it a dense layer of air, which is hard to penetrate, even with coolants at high pressure. Often a specially designed nozzle will solve this problem.

* * *

How Can Industry Meet Rising Manufacturing Costs?

The war has had the effect of raising manufacturing costs to a dangerously high level. Not only has the cost of many raw materials and fabricated parts risen greatly, but labor cost per unit of output has been rising for ten years, and in 1942 was 27 per cent higher than in 1939. Raw material prices, as indicated by the Bureau of Labor Statistics index, were 69 per cent higher in June, 1943, than in August, 1939. Hourly wages of workers in manufacturing plants at the beginning of the war were at an all-time high; they have increased since then, on the average, 51 per cent, and the rise is continuing. All other elements of cost have been rising, and in addition, corporation tax payments have reached a level which seriously interferes with the ability of many companies to create essential reserves for reconversion and for expansion.

In view of these conditions, industrial management is justifiably apprehensive regarding its ability to prevent a rise in prices after the war, which it knows would have consequences that would be detrimental to full employment and business expansion. Industry has done a highly creditable job in keeping prices as low as they are. The index of manufactured goods prices in June, 1943, was only 26.6 per cent above that of August, 1939; this increase was at half the rate for hourly wages, and at a little over a third the rate for raw materials.—*Stevenson, Jordan & Harrison, Inc.*

Fig. 5. Settling Tanks and Filters Comprising Central Station for Supplying Grinding Machine Department with Clean Coolant

Design of Stampings to Facilitate Production

By RALPH A. WAGNER, Chief Tool Designer
Consolidated Aircraft Corporation, San Diego, Calif.

Detailed Data on the Design of Stampings for Quantity Production, Types of Stampings Made, Materials Used, and Die Design Suggestions—Fourth and Last Article

IN the previous installments of this series of articles, the broad classifications of stampings were reviewed, an outline was given of the kinds of materials generally used for stampings, and details of stamping design were covered. In the present article, a number of things to be considered in stamping design are dealt with, such as tolerances and clearances, finishes applied to stampings, and drawings and specifications for stampings. This concludes the series.

Tolerances for Stampings

The widest tolerances permissible should be allowed on all dimensions, as this facilitates rapid production and tends to lower costs. This applies especially to over-all lengths, widths, depths, dimensions of flanges, diameters of formed or raw edges, and distances between hole centers. When a part mates with another part of an assembly, tolerances should never be closer than those for the mating part. Important fractional tolerances should be specified as $\pm$ 1/32, $\pm$ 1/16, or whatever limits are required. Closer limits, if needed, should be given to plus or minus the number of thousandths of an inch essential. The spring-back of metal being stamped and the wear on tools often greatly affect the limits.

Fits and Clearances

When fits are involved, as between two stampings that must mate within close limits, both stampings should be produced by the same plant, as otherwise the desired limit may not be obtained. In any event, the limits that control the fits should be definitely indicated for both parts on the same drawing.

It is good practice to draw, in construction lines, at holes or notches, for example, the part or portion that must be cleared, and to put on the drawing some such note as: "Clearance hole or notch, size not important"; or if the clearances must be close, a note giving, in fractions or thousandths of an inch, the clearance desired. This tells the manufacturer how far he may go in simplifying tooling. He may be able to use an available die, thus saving on tooling costs.

Degree of Flatness Required

When the degree of flatness of any surfaces of a stamping is important, the allowable variation from flatness should be definitely stated, as spring-back in metal and other factors affecting flatness are sometimes difficult and expensive to control. A note on the drawing should read: "This portion must be flat within, say, 0.030 inch"; or "When laid on a surface plate with this surface down, a feeler thicker than, say, 0.016 inch must not pass under the surface at any point." When no such note appears, it is general practice to assume that whatever the tools and metal normally produce is satisfactory to the purchaser.

Straightness, as applied to edges or straight bends, for example—in which camber, spring in the metal, or some other variation from a straight line is objectionable—should be designated, when it is essential, by indicating, in thousandths of an inch, the maximum deviation from a true straight line that is permissible. In some cases, it is better for the user to do his own straightening, as parts straightened by the supplier sometimes warp in shipping, involving double expense for straightening.

In the case of formed or drawn stampings where the shape and location of the edges are not important, this fact should be made clear on the drawing. Otherwise, trimming operations which are not necessary may be performed, because it is not clearly understood that any considerable deviation from the contour shown on the drawing is permissible.

When holes are drilled or when material is blanked or sheared, some burrs are bound to occur. If they must be removed, the drawing should clearly indicate where. When edges must be rounded (or "broken"), this, too, should be clearly indicated, because then tumbling, filing, or some similar operation is required.

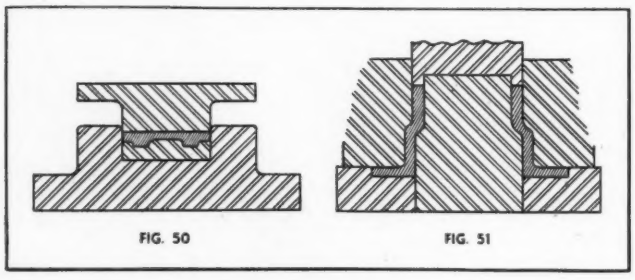
Coining and Coining Dies

Coining is the stamping process in which metal is caused to flow, not as the result of drawing it over an edge, but by the application of extreme pressure or impact, as in forming an imprint on a coin. In coining, the work is made thinner in some areas from which the metal flows and thicker in other areas into which the metal is forced to flow. In reality, coining is a form of forging; but it is commonly done cold, although the metal may be heated. The work is not done by a hammer, as in forging, but in a stamping press or in a special coining press. Except when a very soft ductile metal is being operated upon, however, the unit pressure applied must be very high, and, for this reason, these pressures are commonly applied only to quite limited areas.

Fig. 50 illustrates one form of coining die. Another form, Fig. 51, employs a punch which passes through the piece. The latter is of such shape that some preliminary drawing operations are required. There is, however, some change in section thickness, and the forming of the stepped diameter involves a considerable flow of metal. In this, as in most coined parts, the metal is completely confined within the die cavity, the shape of which it is forced to assume by the high pressures imposed. Some forms of coining are referred to as "stoving."

In producing many coined parts, the flow of metal required is so great that several operations in separate dies, applied in succession, often with annealing between operations, are necessary. To minimize cost, the total flow of metal required should be as small as conditions permit, and the most ductile metal that will meet the requirements, costs considered, should be chosen, especially as coining results in rapid work-hardening.

Relatively few stamping producers have extensive experience in coining. In developing a new design for a coined part, it is well to consult a manufacturer who specializes in coining or who has had experience in producing a similar coined part. His suggestions are likely to prevent a design that would tend to increase costs unduly; probably he will be of great assistance in perfecting a design well adapted to coining at minimum cost.



Figs. 50 and 51. Forms of Coining Dies Used in Shaping Sheet-metal Parts

Operations Supplementary to Stamping Methods

Not all operations in the manufacture of stampings can be accomplished by press-working, as, for example, the curled edge of an automobile fender, which has an irregular contour. The production of such a curled edge in a press generally proves to be impractical; it can be produced more economically by running the piece through curling rolls, during which operation a wire for stiffening is often added inside the curled edge.

Crimped or corrugated edges are produced by crimping rolls which can be changed to suit a number of different sizes and stock thicknesses at small cost. Many stamped parts are threaded by rolling. Lathe attachments have been made to roll such threads for small quantities, but special thread-rolling machines are commonly used for long runs.

Flat blanks, or cylindrical, hemispherical, saucer-shaped, and similar stamped or drawn parts, are often further processed in a lathe by spinning them over a form of either wood or metal. While the work is revolved, a tool mounted on the tool-rest is applied and works the metal over the form to the desired shape. Spinning is frequently done on short runs of parts, especially where tool costs would be prohibitive if the entire job were done in press dies. In some cases, the dimensions held are closer than for drawn parts. It is also possible to neck parts over collapsible forms when such a shape could not be produced by drawing or shaping in regular dies.

Punchings called "knock-outs" are sometimes left in stampings, the slug which has been produced by the punch being pushed back into place, so that the surface, except for the cut line, is flush with the surface of the surrounding metal. Knock-outs are commonly used in steel boxes for electrical circuits, and are knocked out, when the box is installed, at points where conduits are led into the box from one or more sides. Such boxes are frequently designed with several knock-outs. Those not having to be knocked out remain in place, leaving surfaces which serve the same purpose as if the holes were not punched.

In designing products of this nature, the designer should keep the holes well away from flanges and from the edges of the metal, so that the surrounding metal will not be distorted while the knock-out is being formed. In most cases, the holes are not sheared through the full circumference, but the metal is left continuous

at one or two spots, where the metal is broken later, when and if the slugs are pushed out.

Occasionally, where a small boss must be thrown up on a stamping, a slug is punched only half way through and is left in the hole, but projecting half the thickness of the slug. The projection thus formed may serve to locate some mating part, but since it is held only by friction, it should not be depended upon to resist heavy stresses. Bosses of this type are useful chiefly when fairly heavy gage metal is employed.

Finishes Applied to Stampings

If stampings are to receive an applied finish, it should be clearly specified whether cleaning and corrosion preventive treatment are required, and what kind and color of primer and paint are to be used. If a definite color or shade is not important and another can be substituted, this should be noted. In case a particular method of application is necessary, it should be stated whether the part must be brushed, dipped, or sprayed, baked or "crinkled."

It is advisable to state clearly what the part is and where and how it is used. An assembly drawing provided along with the part drawing is helpful to an estimator as indicative of use and to show where fits with mating parts must be considered.

Appearance, especially of exposed parts, should be pleasing to the eye even though, from a strictly engineering standpoint, this may seem to be of minor significance. From a sales standpoint, appearance is often a highly important, if not a controlling, factor, especially in stampings exposed to view in the finished product.

In general, a stamping with an attractive appearance costs no more than an ugly one which may serve its purpose well enough as to strength and stiffness, but which is not conducive to ready sale. Simplicity usually enhances rather than detracts from appearance, and often promotes low cost. Straight lines are pleasing when proportions are correct, and also, in general, make for low costs; but sharp square corners at bends should be avoided for reasons already explained.

So-called "streamline" designs—that is, those which involve smooth exteriors, free from projections and unnecessary irregularities—are likely to be of value from both an appearance and cost angle; but if curves in two or more planes are introduced, forming dies are required; such designs are likely to cost much more than if straight lines or curves in one plane only were maintained.

Stampings are often used to hide unsightly interior parts, and for such applications should be made, of course, to harmonize or blend with mating parts and to enhance rather than detract from the appearance. Very often flanges that would be unsightly if exposed can be used to promote stiffness and contribute other benefits. They can still remain hidden in the assembly.

When the designing engineer lacks a good sense of proportion or when there are other factors which affect general appearance, he will do well to employ an artist or industrial designer, at least to establish external lines and contours. The resulting design need not, and certainly should not, be permitted to sacrifice any engineering advantage of significance, and should, of course, be checked for soundness from an engineering standpoint. When this is done, the artist and the engineer supplement each other's efforts, and the result is a credit to both. Far from detracting from the work of either, the proper design gains the objective of good appearance and sound engineering—both consistent with moderate cost—and yields a product that should appeal to the consumer.

Wherever quality is important, the specific factors required should be plainly noted. If the designer asks himself what he would need to know if he were to produce the stamping, and gives the production department this information, there should be no trouble in securing what is needed.

Drawings and Specifications for Stampings

A stamping that is considered satisfactory by the manufacturer may not be so regarded by the purchaser. The price set by the estimator may be either greater or less than is necessary to produce a satisfactory stamping for the particular use involved, all because of lack of information and consequent misinterpretation of drawings presented for quotation. This results in misunderstandings between the purchaser and manufacturer.

On the purchaser's side, there is the engineer who provides the necessary drawings and information, the purchasing agent who does the buying, and the inspection department which passes or rejects the stampings purchased. The manufacturer has engineers who control methods and quotations, the salesman who contacts the purchaser, and the production department which must manufacture the finished product to the satisfaction of the purchaser's inspection department. For the satisfaction of all concerned, the purchaser and manufacturer should get together with definite information furnished by their respective engineering departments, if a fair price and a satisfactory product are to be assured.

The designer should supply as complete information as possible regarding the requirements. He should furnish reasonable specifications on (or with) the part drawing and in such

form that they can be easily interpreted by others. Often the designer does not know the method of manufacture to be followed in making the particular part he is designing; but since he can design much more intelligently if he understands production methods, he can profit greatly by discussing the design with the engineers of the stamping manufacturer, and thus adapt the design to economical production.

The designer may not know, for example, whether the stock will be blanked or sheared to size, but it does make a difference in the product, as more variations occur in shearing than in blanking; and when the stamping is formed, the height or width of flanges may vary if sheared. If a channel-shaped part is involved, the web width may vary because of the method used in forming. It may be formed in a standard "V" die in two hits of the machine, which would give variations in width because of variations in gaging; or it may be formed in a die built especially for the job, in which case the width may be held reasonably close, because both flanges are formed at one time. All metal has some spring-back. This may cause dimensional variations; for example, the flanges of a channel may open out slightly, but it may or may not be necessary to hold these flanges to an exact 90-degree angle relative to the web.

As to general appearance, there are exposed and unexposed surfaces, and any marks or wrinkles may influence greatly the tooling costs involved. Exposed surfaces, in most cases, should be free from marks and wrinkles, but on unexposed surfaces they may not matter; yet the estimator has to guess at the requirements if there is no notation on the drawing. This may raise the price needlessly, in order to permit the supplier to "play safe." Flatness and straightness are sometimes essential, but if not plainly specified, may be overlooked, with resulting misunderstandings or rejections which could be avoided by precise specifications. Assembly requirements also affect such items as lengths, clearance, notches, and fits.

These are only a few of the factors that the designer should cover in specifications intended to insure satisfactory stampings. It is evident, however, that clear and complete drawings and specifications, and close cooperation with the stamping manufacturer is the logical way to get results and effect economies that may not be realized otherwise. If, before designs are finally approved and specifications drawn, they are checked against the rules given in these articles, many oversights that have a bearing on cost can be avoided. Stampings are not machined parts, and limits cannot be held so closely as machining methods permit. The more flexible the specifications are, the less costly the stamping will be.

Government Inspectors Checking the Weight of 155-millimeter Shells in One of the Production Lines of Willys-Overland Motors, Inc., as the Shells Pass by on a Roller Gravity Conveyor. The Weight Must Meet Specifications within 0.10 Pound

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Plastic Mask for Use in Chromium Plating

What is believed to be one of the largest Saran parts ever to be injection-molded is a 35-ounce mask for use in chrome plating wartime aircraft landing gear struts. This mask was fabricated by the St. Louis Molding Co., St. Louis, Mo., on a modified Watson-Stillman machine, a molding cycle of only 70 seconds being required. Because of its high chemical resistance, lightness, strength, and toughness, Saran was found to be especially fitted for use as a mask to prevent plating certain parts of the landing gear. The plastic is reported to be unaffected by the highly corrosive elements of the plating solution...201

High Heat-Resistant Lucite Plastic Molding Powder

A new Lucite plastic molding powder that will withstand much higher temperatures than have been previously possible with commercial thermoplastic powders was announced recently by Dr. G. M. Kuettel, of the plastics department of the E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

This new powder, called high heat-resistant Lucite methyl methacrylate resin molding powder, is a war development of the du Pont plastics research laboratories. Airplane flying light lenses, dial and meter faces, medical and dental instruments, and airport and railroad signal light lenses are among the applications for which this plastic molding powder has been developed. Many articles molded from this new powder will not soften appreciably or become distorted when exposed to a temperature of 212 degrees F. This is 30 to 40 degrees above the useful temperatures for similar articles previously produced from other commercial thermoplastic molding powders.

The high heat-resistant Lucite has approximately the same mechanical, optical, electrical, and molding properties as the general-purpose Lucite molding powders now used for reflectors on military vehicles, army compasses, navy control equipment indicators, and other ordnance items. Articles made from this powder can be transparent and colorless, or the powder can be dyed or pigmented to desired colors. General-purpose Lucite powders will continue to be produced for molded articles not requiring high heat resistance. Both types are under allocation for war uses. 202

Insl-X Temporary Coating for Metal Surfaces

A temporary protective coating for metal surfaces which can be applied by brushing or dipping and which air-dries in from five to fifteen minutes has been developed by the Insl-X Co., Inc., 857 Meeker Ave., Brooklyn, N. Y., under the name "Insl-X." The coating is easily stripped off by hand, no solvents being required. All types of surfaces, whether rough or smooth, are easily covered by this new coating. It is said to have withstood 100-hour, 3 per cent salt-spray tests when applied on steel, copper, brass, and aluminum. 203

Plastic Ball-Bearing Retainer Rings for High-Speed Bearings

At high speeds, according to Westinghouse engineers, retainer rings in ball bearings become a limiting feature. By using plastic retainers instead of metal ones, these limitations are largely overcome. It has been found that retainers made from Micarta have the required mechanical strength, coupled with light weight. They can be accurately machined by automatic equipment, and hence produced economically. While sufficiently rigid for their purpose, they are flexible enough to resist vibration, fatigue, and shock.

It is stated that these plastic retainer rings have been used on grinding spindles running at speeds as high as 60,000 revolutions per minute. In one instance, the retainer rings have been employed in bearings that have made 18,000,000,000 revolutions, and in another case, they have given fifteen months of continuous service. 204

To obtain additional information on materials described on this page, see lower part of page 178.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 177 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the February Number of MACHINERY

Decimal Equivalent Chart Calendar

DAYTON ROGERS MFG. CO., 2835 Twelfth Ave. South, Minneapolis 7, Minn., is distributing two sizes of decimal equivalent chart calendars —one 7 by 15 and the other 13 by 27 inches. Copies can be obtained upon request on a company letterhead. 1

Locking System for Threaded Inserts and Studs

BARDWELL & MCALISTER, INC., 911 N. Orange Drive, Hollywood 28, Calif. Standards catalogue and Design Data Sheet catalogue, describing the Rosan locking system for threaded inserts and studs, and showing many types of applications. 2

Thread Grinding

DUMORE CO., 14th and Racine, Racine, Wis. Bulletin 25, entitled "Thread Grinding Simplified," containing instructions for setting up a thread grinding attachment on the Dumore No. 5 grinder. Tables of helix angles for U.S.S. and Acme screw threads are included. 3

Induction Heating

OHIO CRANKSHAFT CO., TOCCO DIVISION, Cleveland 1, Ohio. Booklet describing the underlying principles of the Tocco process of induction heating of steel for hardening, and its application. Several case records are included to show the great economies effected. 4

Military Parts Packaging Chart

E. I. DU PONT DE NEMOURS & CO., INC. (Technical Section, Cellophane Division), Wilmington 98, Del. Chart containing packaging specifications for military machinery and parts as issued by the Ordnance Corps, Engineering Corps, and Air Corps. 5

Metal Cleaning and Drying Machines

INDUSTRIAL WASHING MACHINE CORPORATION, New Brunswick, N. J. Catalogue illustrating and describing this company's line of metal cleaning and drying machines, as well as parts for which this equipment is suitable. 6

Manganese Steel for the Railroad Industry

AMERICAN MANGANESE STEEL DIVISION OF AMERICAN BRAKE SHOE CO., 230 Park Ave., New York City. Bulletin 943-R, descriptive of the properties of manganese steel and its applications in the railroad industry. 7

DoAll Tools

DOALL SERVICE CO., 1201 Thacker St., Des Plaines, Ill. Catalogue on DoAll products, covering contour sawing and filing machines, cutting tools and attachments, coolants and lubricants, speed controls, presses, powdered metals, etc. 8

Grinding-Wheel Dressers

CALDER MFG. CO., 626 N. Prince St., Lancaster, Pa. Catalogue 38, listing the complete line of grinding-wheel dressers and cutters made by this concern. Folder describing the time-saving advantages of these tools. 9

Stamping Trimmer

QUICKWORK DIVISION OF WHITING CORPORATION, 15673 Lathrop Ave., Harvey, Ill. Bulletin QW-115, illustrating and describing the Quickwork-Whiting stamping trimmer for straight-line production or job shop work. 10

Steel Cutting with Carbides

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Ave., Detroit 32, Mich. Vest-pocket handy guide containing information on how to obtain top performance in cutting steel with Carboloy cemented carbides. 11

Instruction Sheet for Torch Brazing

HANDY & HARMAN, 82 Fulton St., New York 7, N. Y. Instruction Sheet (8 1/2 by 11 inches) for torch brazing with Sil-Fos and Easy-Flo silver solders; also obtainable as a wall chart. 12

Maintenance Data

ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis., is issuing a new pocket-sized magazine entitled "Operation and Maintenance Review," succeeding the company's publication "Victory Production and Maintenance News." 13

Brass and Aluminum Castings

MANUFACTURERS BRASS FOUNDRY CO., INC., 7756 Dante Ave., Chicago 19, Ill. Catalogue entitled "The Doorway to Satisfaction in Brass," showing the various steps in the production of brass and aluminum castings. 14

Welded-Steel Baskets

YOUNGSTOWN WELDING & ENGINEERING CO., Youngstown, Ohio. Catalogue showing a wide variety of welded-steel crates, baskets, chains, and accessories used in pickling, annealing, and heat-treating operations. 15

Portable Elevating, Piling, and Stacking Machines

REVOLVATOR Co., North Bergen, N. J. Bulletin 139, entitled "The Art of Piling for Modern Industry," showing applications of the Revolvator portable elevator. 16

Conversion Tables for Milling Cutter Rake Angles

DETROIT TAP & TOOL Co., 8432 Butler Ave., Detroit 11, Mich. Technical manual containing conversion tables for milling cutter rake angles, for use in sharpening thread milling cutters, gear hobs, etc....17

Steels

JESSOP STEEL Co., Washington, Pa. Bulletin 443, giving data on Jessop 2-B tungsten hot-working die steels. Bulletin 543, on Jessop water-hardening tool steel for applications requiring toughness....18

Direct Positive Printing Paper

JOHN R. CASSELL Co., INC., 110 W. 42nd St., New York City. Circular describing "Casco-Azo" ammonia developing positive printing papers, and sepia transparent sensitized tracing paper. 19

Industrial Instruments

BRUSH DEVELOPMENT Co., 3315 Perkins Ave., Cleveland 14, Ohio. Catalogue on Brush electric crystal-actuated recording devices, including oscillographs and surface analyzers. 20

Safety Goggles

AMERICAN OPTICAL Co., Southbridge, Mass. Booklet entitled "Right on the Nose," describing quick and easy methods of adjusting industrial safety goggles fitted with non-prescription lenses....21

Welding Inspection Chart

LINCOLN ELECTRIC Co., Cleveland 1, Ohio. Illustrated chart designed to enable arc-welding machine operators and inspectors to tell at a glance whether welds are being properly made. 22

Cutting Fluids

STANDARD OIL Co. OF NEW JERSEY, 26 Broadway, New York 4, N. Y. Pamphlet entitled "Cutting Fluids," describing various types and their applications. 23

Coated Abrasives

BEHR-MANNING CORPORATION, DIVISION OF NORTON Co., Troy, N. Y. Second edition of a booklet containing basic information on coated abrasives for users....24

Hard-Facing Alloys

WALL-COLMONOY CORPORATION, 720 Fisher Bldg., Detroit 2, Mich. Catalogue 75, describing characteristics and applications of Colmonoy hard-facing alloys. 25

Welding Alloys

EUTECTIC WELDING ALLOYS Co., 40 Worth St., New York City. New monthly publication entitled "The Eutectic Welder," containing information on welding production, reclamation, and salvage. 26

Meehanite Milling Cutter Bodies

FARREL-BIRMINGHAM Co., INC., Ansonia, Conn. Bulletin 270, descriptive of Farrel Meehanite milling cutter bodies and tool shanks, supplied as unfinished castings....27

Machine Tools and Equipment

JEFFERSON MACHINE TOOL Co., 673-773 W. Fourth St., Cincinnati, Ohio. Catalogue covering the Jefferson line of precision milling machines, attachments, and other machine equipment. 28

Grinding and Polishing Equipment

MUMMERT-DIXON Co., Hanover, Pa. Condensed catalogue illustrating and describing this company's line of grinders, facing and boring heads, etc. 29

Fluxes for Welding, Brazing, or Soldering

KREMBS & Co., 676 W. Ohio St., Chicago 10, Ill. Chart recommending the most satisfactory flux to use when joining common metals and alloys by different methods....30

Tungsten Electrodes

CALLITE TUNGSTEN CORPORATION, 540 Thirty-ninth St., Union City,

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To Obtain Copies of New Trade Literature

listed on pages 176-178 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

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[SEE OTHER SIDE]

N. J. Bulletin 154, on Callite tungsten electrodes for atomic hydrogen, helium, and argon arc welding. 31

Service Procedure for Ball Bearings

NEW DEPARTURE DIVISION GENERAL MOTORS CORPORATION, Bristol, Conn. Booklet ND—A57, illustrating and describing correct procedure in servicing ball bearings.....32

Heat-Treating

REX & ERB, Lansdale, Pa. First issue of a publication entitled "Heat-Treating Topics," which will be issued at regular intervals for the use of those responsible for work involving heat-treating.....33

Carbide Cutting Tools

CARBIDE TOOL ENGINEERING CO., 4439 Lincoln Ave., Chicago, Ill. Circular listing "Do's and Don'ts" for carbide cutting tools. Bulletin containing data on straight-shank carbide-tipped end-mills. 34

Metallizing Guns, Wires, etc.

METALLIZING ENGINEERING CO., INC., 38-14 Thirtieth St., Long Island City 1, N. Y. Catalogue 42B, describing Metco metallizing guns, wires, surface preparing tools, and metallizing accessories. 35

Carbide-Tipped Tools

CARBIDE FABRICATORS CO., Royal Oak, Mich. Catalogue and engineering manual on carbide-tipped tools, including lathe tools, reamers, end mills, core drills, and centers. 36

Hydraulic Presses

A. B. FARQUHAR CO., 185 Duke St., York, Pa. Bulletin P5M43, illustrating and describing the complete Farquhar line of self-contained hydraulic presses. 37

Welding Positioners

QUICKWORK DIVISION, WHITING CORPORATION, 15673 Lathrop Ave., Harvey, Ill. Bulletin QW-116, illustrating various types of Whiting special welding positioners.....38

Portable Balancing Equipment

VIBROSCOPE, INC., 6 E. 39th St., New York 16, N. Y. Bulletin 12-V, illustrating and describing Davey portable dynamic balancing equipment. 39

Hydraulic Surface Grinders

SAVAGE TOOL CO., Minneapolis, Minn. Catalogue covering the complete line of DoAll hydraulic surface grinders and accessories.....40

Hydraulic Molding Presses

ELMES ENGINEERING WORKS, 230 N. Morgan St., Chicago 7, Ill. Bulletin 5000, descriptive of hydraulic plastic molding presses. 41

Open-Back Inclinable Presses

FEDERAL PRESS CO., Elkhart, Ind. Bulletin 10, illustrating and describing the Federal line of open-back inclinable presses. 42

Metal-Marking Equipment

WM. A. FORCE & CO., INC., 216 Nichols Ave., Brooklyn 8, N. Y. Booklet on metal-marking equipment for industry. 43

Synthetic Rubber

NEW YORK BELTING & PACKING CO., 1 Market St., Passaic, N. J. Booklet entitled "Facts About Synthetic Rubber." 44

Chain Hoists

CHESTER MFG. CO., Lisbon, Ohio. Leaflet announcing the Chester chain hoist. 45

Care of Chain Belts

CHAIN BELT CO., Milwaukee, Wis. Bulletin entitled "Wartime Care of Chain Belt Drives."....46

* * *

Steel Production in 1943 Reached Record Level

The American steel industry produced approximately 89,000,000 tons of steel ingots in 1943. This is a record figure for the industry. What is more, it is the fourth year in succession in which past production records have been broken. Previous consecutive record years were 1897, 1898, and 1899, and again 1915, 1916, and 1917.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 190-212 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in February, 1944, MACHINERY.

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To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on page 175, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in February, 1944, MACHINERY.

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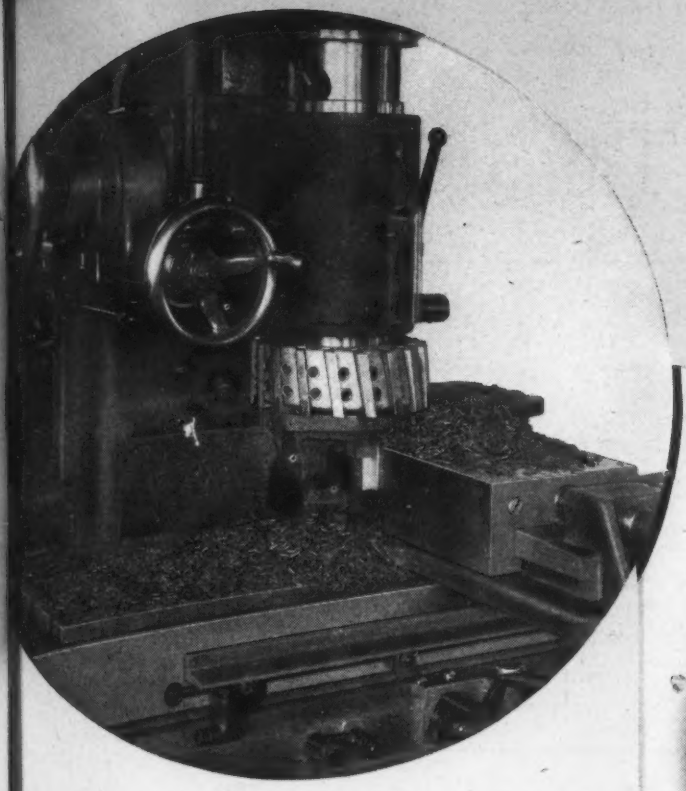

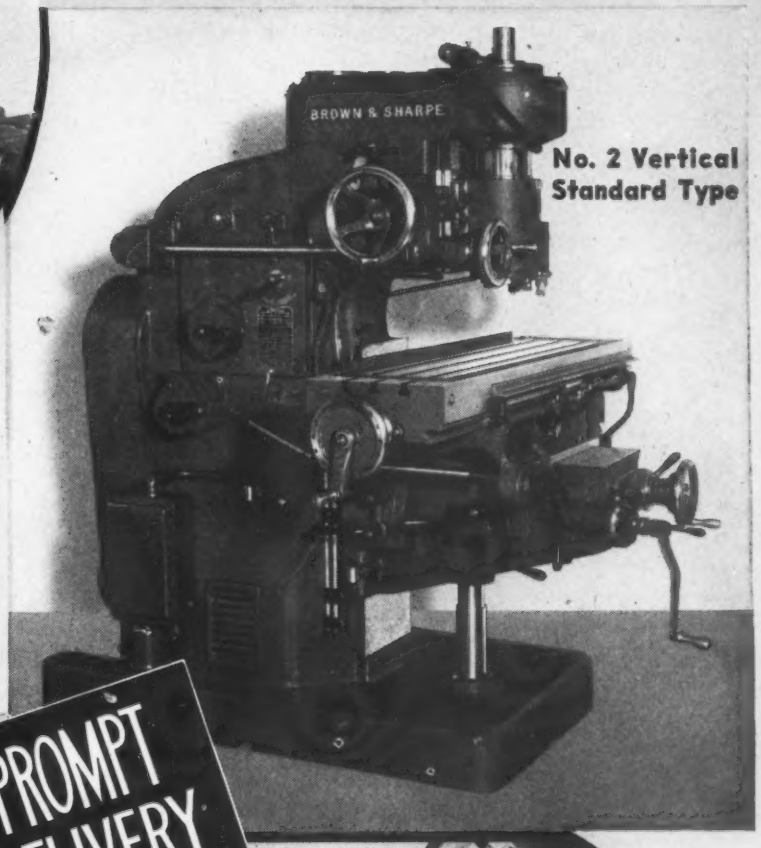

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Designed for Broad Utility, Rapid Set-up, Efficient Operation and Maximum Rigidity Under Capacity Loads.

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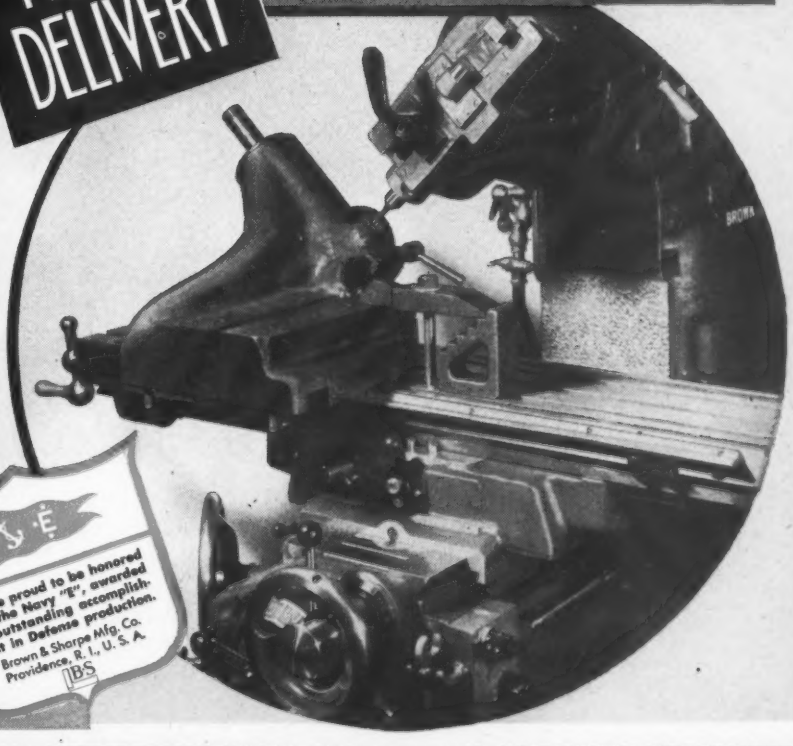

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Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

BROWN & SHARPE

Manufacturing Tails for Bombs

THE standard incendiary bomb used by the Royal Air Force is hexagonal in cross-section, and is made to fall vertically by the provision of a hollow hexagonal tail unit, which is about 8 inches in length. The tail is closed at one end, while the open end is attached to the main body of the bomb. Incendiary bombs are comparatively light in weight, and in consequence, a bomber can carry large quantities of them and can afford to scatter them widely over the target area. It follows, therefore, that the quantities required are comparatively large.

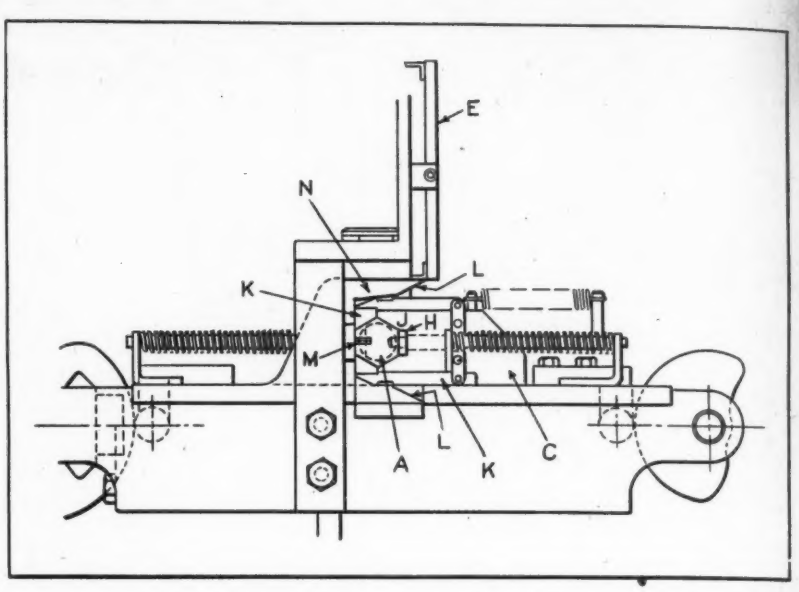

Fig. 2. End View of Hexagonal Tube-forming Machine

The methods to be described are those of a company engaged in manufacturing bomb tails in England. Before the war, this firm manufactured light engineering specialties, mainly for the automobile industry. The section of the factory devoted to bomb-tail manufacture was reorganized, and the methods of production revised, the result being an increase in production of about 30 per cent.

The tail unit is made from tin plate, 0.012 inch thick. Each sheet of material, as received at the factory, is cut into two pieces by guillotine shears, and from each half sheet four bomb tails are made. Stages in the production of the bomb tail are shown in Fig. 1. The blank *A*, two edges of which are flanged, is formed into the hexagonal tube shown in two positions at *B* and *C*, after which the end *D* is inserted and soldered in position. The completed tail is shown at *E*.

The press that produces four blanks from each half sheet of material is of the double-action type, cutting the material and forming the side flanges at the same time. A set of tools at the front of the press cuts blanks from the farther right-hand corner of the material, each blank, in turn, then falling to the rear of the press, where the flanges are formed at the next stroke. In operation, the sheet is inserted and the press operated to produce a blank. The sheet is then withdrawn, turned over, and reinserted to allow another blank to be cut and the previously produced blank to be flanged. After the second blank has been cut out, the sheet is again withdrawn and manipulated in the same manner to

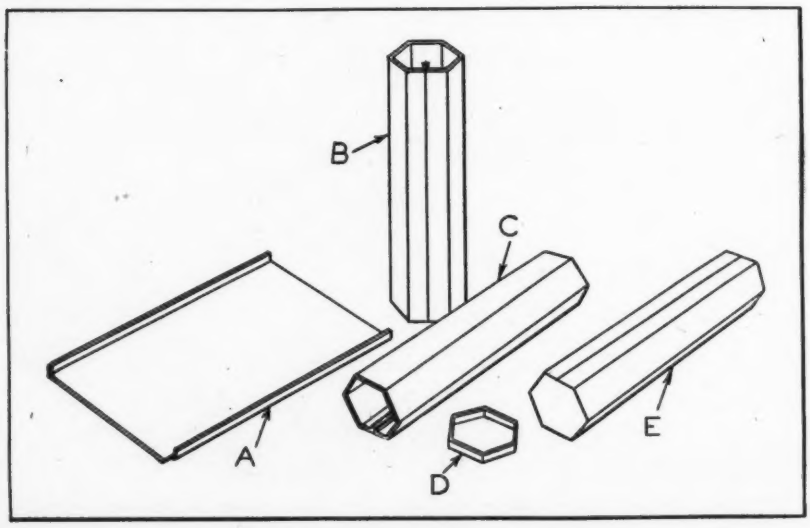

Fig. 1. (A) Flanged Blank for Bomb Tail; (B) and (C) Hexagonal Tubes Formed from Blanks Like One Shown at A; (D) Closing Piece for End of Tube C; (E) Bomb Tail with End Piece D Soldered in Place

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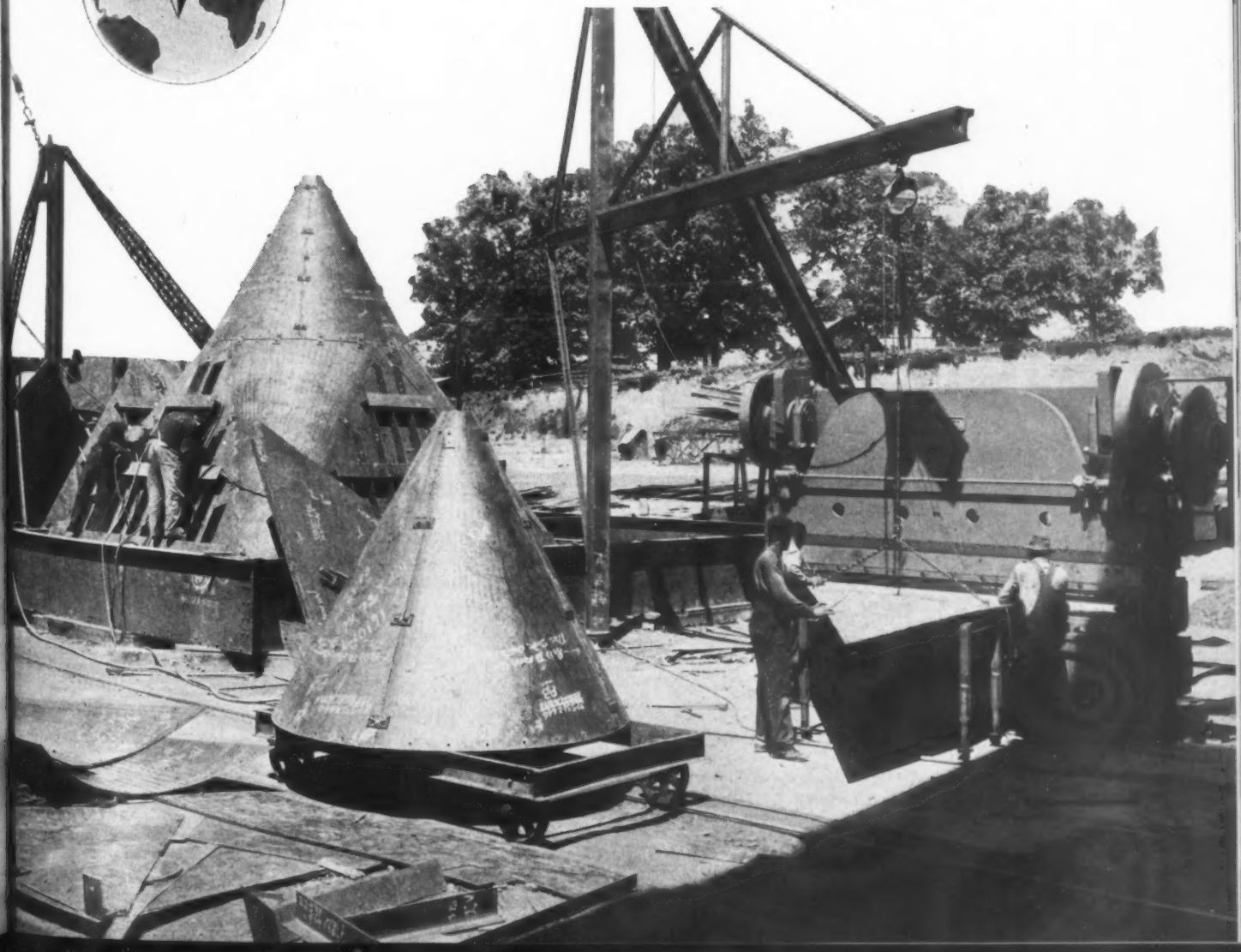


produce a blank from the third corner of the material, and the procedure is repeated for the fourth corner. At each stroke of the press, one flanged piece is produced.

Probably the most interesting operation in the production of the bomb tail is the forming of the flanged blank into a hexagonal tube. This operation is performed on an automatic machine especially designed for the purpose, which forms the tube and closes the seam, finally ejecting the finished tube which falls on a chute that conveys it to the next operation.

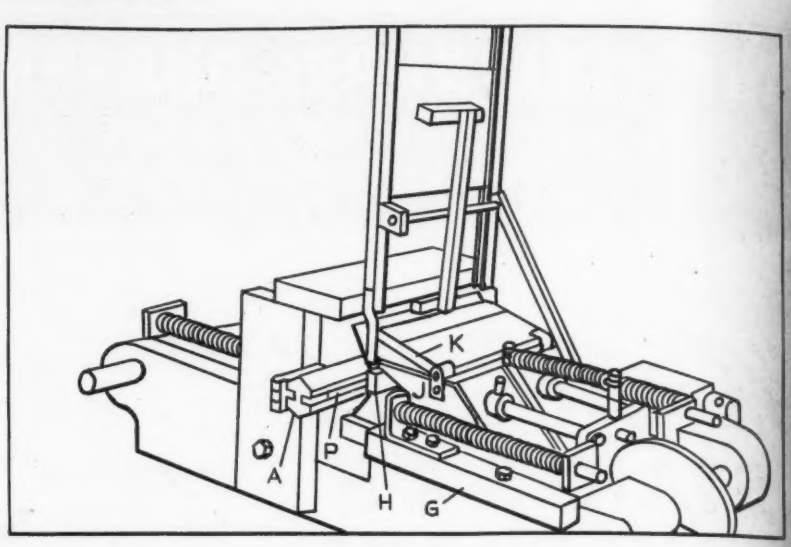


Fig. 4. Tube-forming Machine at Another Stage in the Operating Cycle

An end view of the tube-forming machine with the members at the end of the forming stroke is shown in Fig. 2. Figs. 3 and 4 show the machine in two different positions of the operating cycle. The same reference letters are used for identical parts in all three illustrations.

The forming machine is provided with a longitudinal slide which carries the tube-forming mandrel *A*, while cam-operated cross-slides carry the forming tools *J*, which move at right angles to the direction of movement of the mandrel. In Fig. 3, a completed hexagon tail tube is shown being ejected at *B*, while the blank at *C* is in position to be formed between the horizontal mandrel and the forming tools seen in the foreground. Fig. 4 shows the forming tools *J* approaching the mandrel to commence the forming of a blank after a finished tube has been completely ejected and has fallen on the chute.

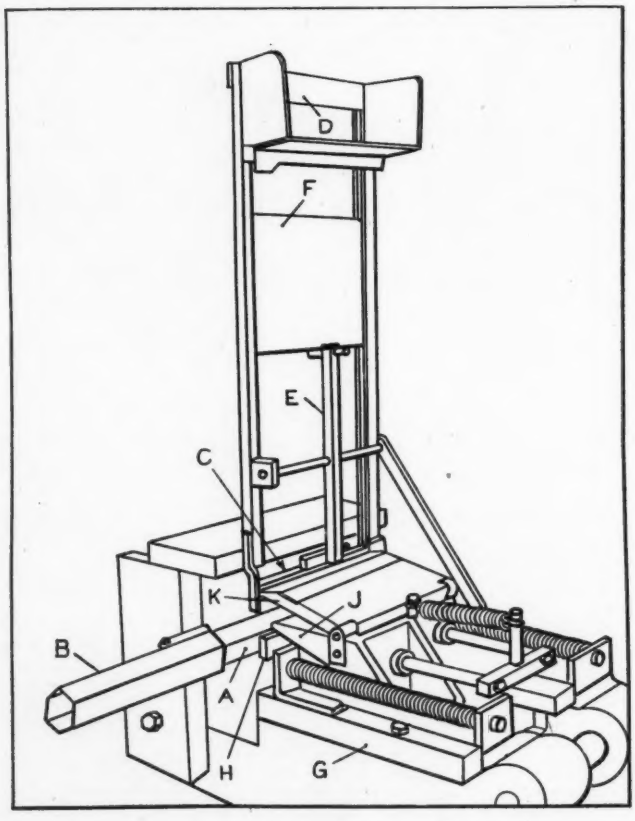
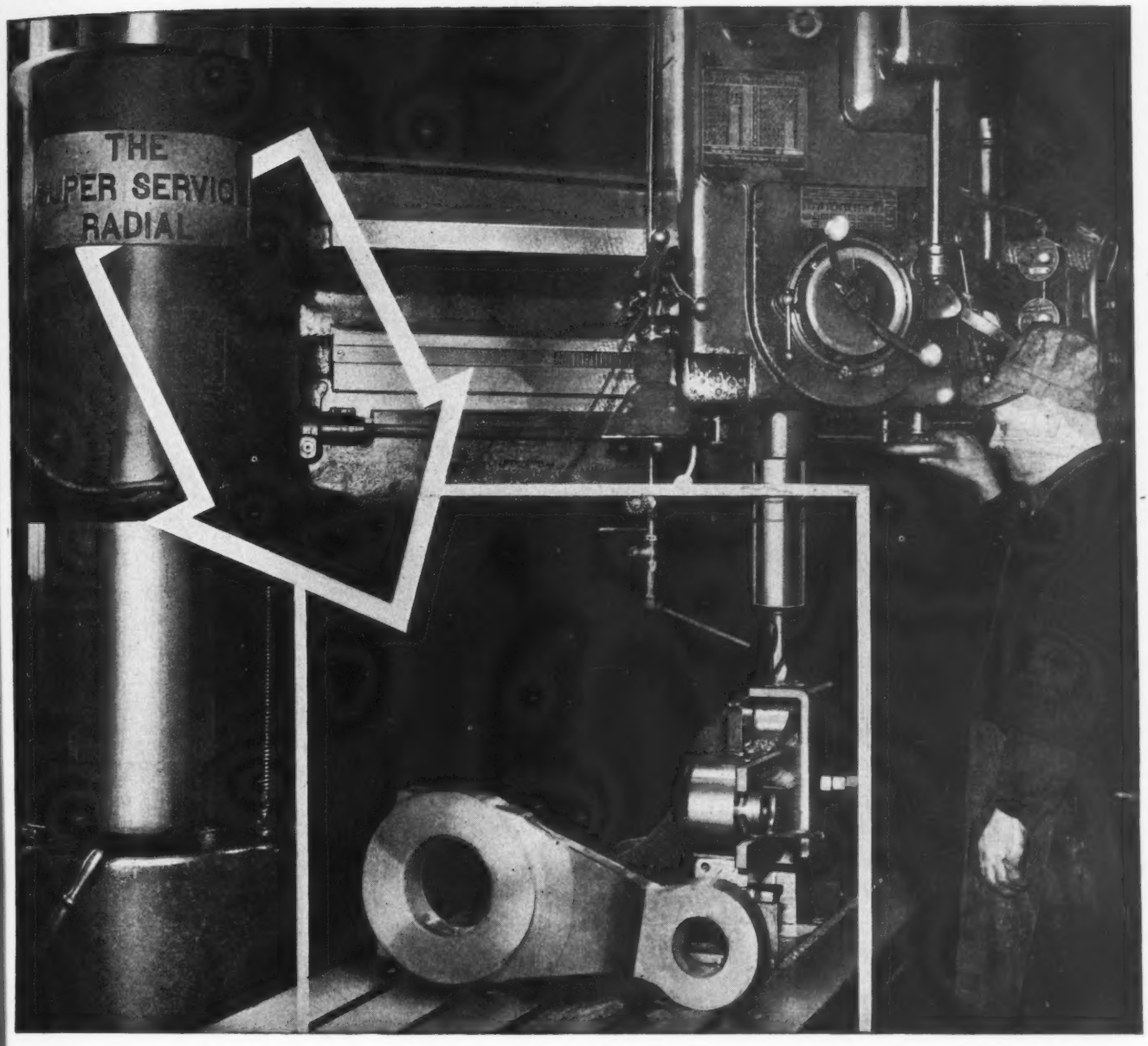


Fig. 3. Tube-forming Machine, with a Formed Hexagonal Tube Shown at B

The flanged blanks are placed in the magazine at *D*, Fig. 3, the loading arrangements being such that it is impossible to load a blank in the incorrect position with the flanges pointing outward. From the magazine, the blanks are allowed to fall, one by one, to the position occupied by the blank *C*. A rocking bar *E* provides for releasing the blanks to the working position. It has rests at its upper and lower ends, and as it rocks backward and forward about its central pivot, the blank is first of all arrested by the upper stop, as shown at *F*. From position *F* the blank falls to the lower stop at the next cycle of operations, while at the following cycle it is released from the lower rest or stop to the position assumed by the blank *C*. There is thus a constant flow of blanks to the working position, a blank being loaded in position for operation at each reciprocation of the horizontal mandrel *A*.

Assuming that the work *B* has been ejected, and the blank *C* is in position ready for forming, the sequence of tool motions is as follows: The slide *G* moves inward toward mandrel *A*, the block *H* first of all engaging the blank and holding it firmly against the upright face of the hexagonal mandrel while the tool *J* presses it against the two faces adjacent to the upright face. In Fig. 4, the tool *J* is seen approaching the mandrel while block *H* holds the blank to the vertical face. The tools may also be seen in Fig. 2.



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The Cincinnati Bickford Tool Co. is now developing drilling machines that produce victorious results and will continue to hold those high standards for many years to come. The Engineering Staff is not satisfied to rest on laurels that won their Super Service Metal Drilling Machines the slogan of More Holes per Dollar, but they are ever searching for improvements that will continue to keep the Cincinnati Bickford Tool Company's name in that category of one who builds machines that drill MORE HOLES PER HOUR.

ARMY E NAVY

Drilling to close parallelism is an important operation at the American Locomotive Company Plant. The parts so drilled are eccentric cranks which are to be bolted to main crankpins. Long holes are required; specifications call for drilling these holes closely parallel to the vertical center lines passing through both bearings. The machine used for this precise operation (illustrated above) is the **Cincinnati Bickford Super Service Radial with numerous features to insure consistently accurate performances in high speed production of numerous vital products needed for America's gigantic Victory output.** Write to Cincinnati Bickford for detailed information on all models of Super Service Radials and Upright Drills.

THE CINCINNATI BICKFORD TOOL CO. OAKLEY, CINCINNATI, OHIO, U. S. A.

Upper and lower hinged tools *K* are provided, which normally are held in the open position shown in Figs. 3 and 4 by the action of strong springs. A cam-operated rear slide next comes into operation, and the inclined faces *L* of the tool *N*, Fig. 2, engage the sides of the blank and commence to turn them inward. Continued movement of the rear slide causes the inclined faces *L* to engage the inclined faces of the tools *K*, thus forcing them inward on the work, and closing the blank completely around mandrel *A*.

Mandrel *A* now commences to withdraw and move through the tube formed from the blank. It is provided with a number of rolls *M*, Fig. 2, and these fold over the flanges of the blank to form and close the longitudinal seam.

At the end of the stroke of the ram carrying the mandrel, spring-operated catches *P*, Fig. 4, move outward as they are uncovered by the mandrel emerging from the work. The result is that on the return stroke of the ram, after the cross-slides have withdrawn, the work is carried outward on the end of the mandrel to the position *B*, Fig. 3, a latch preventing the tube from being drawn into the machine again at the next stroke of the ram.

The machine operates at high speed, and is completely automatic in action, the operator simply keeping the magazine supplied with blanks. It was designed and made in the factory in which it is being used.

The operation that follows the tube forming is also interesting. It consists of inserting the flanged hexagonal end piece *D*, Fig. 1, into the tube to bring the work to the stage shown at *E*. The end piece is a comparatively tight fit in the tube.

It will be obvious that it is a simple matter to push a closing piece of the form shown at *D* into the tubular piece *B*, provided that the closing piece is inserted edgewise; that is to say, with two opposite edges in contact with two opposite walls of the tube. This would apply also, of course, in the case of a tube and closing piece of rectangular form.

This fact is made use of in the closing device that has been developed, which also provides for turning the closing piece after it has been inserted until it is correctly positioned at the end of the tube. The ends are soldered in position by standing the tails, closed ends downward, in a shallow bath of molten solder. After remaining in the bath for a few moments, the bomb tails are removed. The solder sets hard almost immediately, and the work is brushed by bringing it into contact with rotating cloth buffs. The longitudinal seam is not soldered, as this is unnecessary.

After the soldering operation, a locking hole is cut by a simple operation on a press, and the work is then oiled both internally and externally.

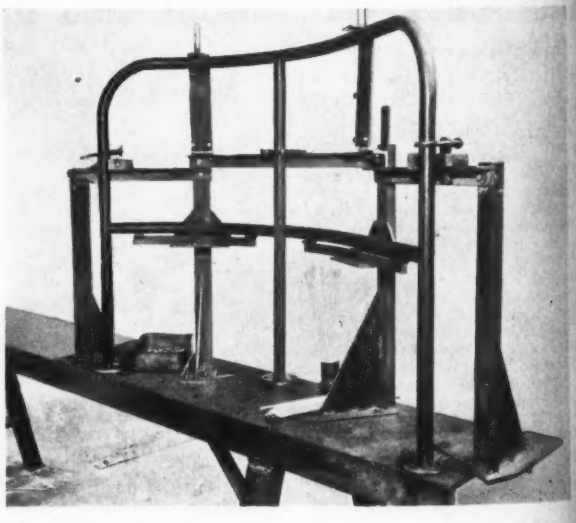
Arc-Welding Fixture Designed to Speed up Guard-Rail Production

Fabricating structures of unusual shape and unconventional design presents no serious problem to the versatile arc-welder. The unique welding fixture shown, for example, when used with arc-welding equipment made by the Lincoln Electric Co., serves to speed up the construction of guard rails for gun-mount platforms at the plant of Farwell, Ozmun Kirk & Co., St. Paul, Minn.

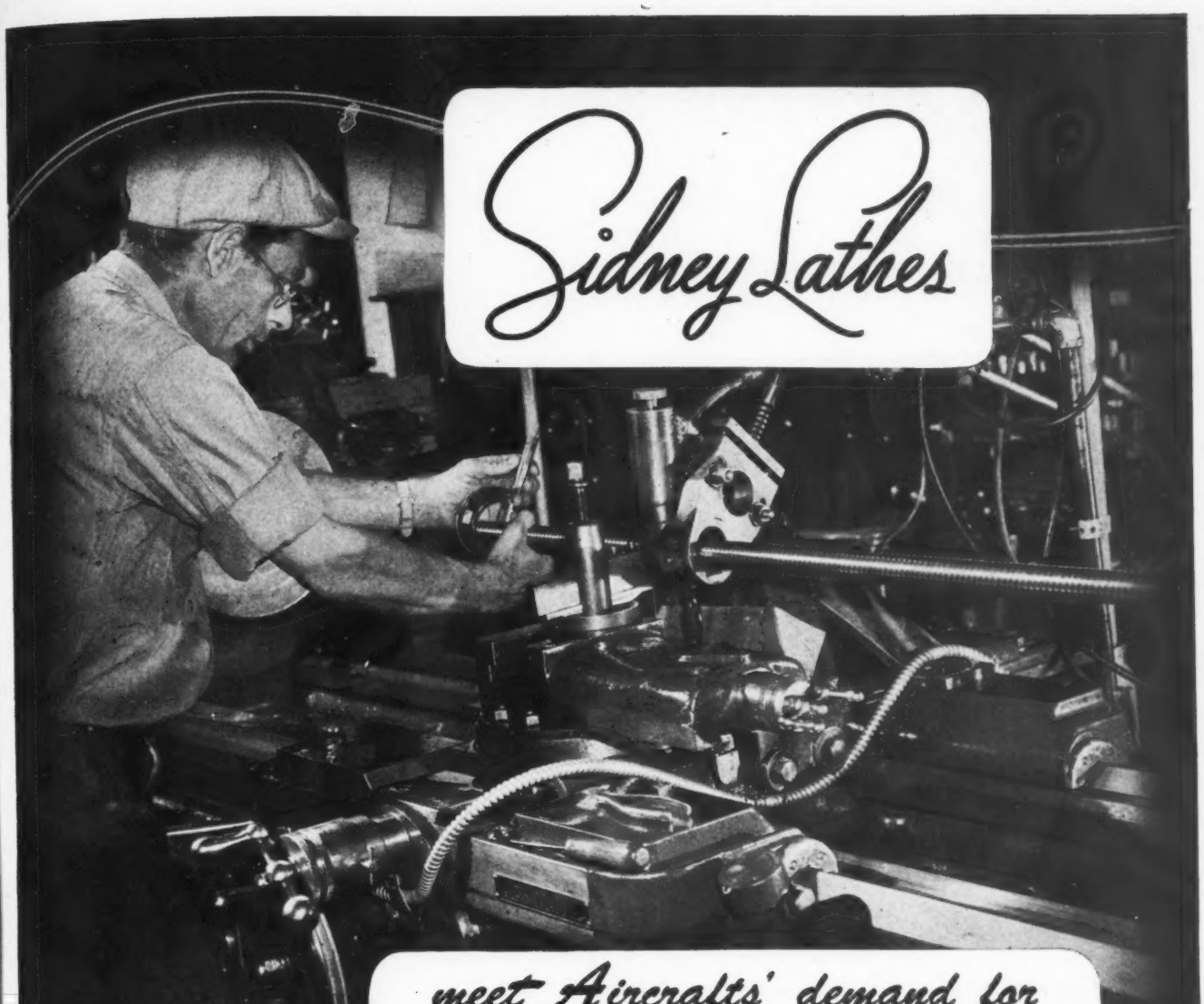
This fixture, now being used for volume production of essential war equipment, is made of several pieces of tubing and angle-iron, fused together by means of the electric arc. It is interesting to note in this connection that a 20 per cent saving in electrodes was effected by employing 5/32-inch electrodes for welding the guard rail in place of the 3/32-inch size that was formerly used.

The method used in constructing the welding fixture represents an interesting application of a simple design to expedite positioning of the tubular pieces from which the rail guard is made. As may be noted by referring to the illustration, the jig consists of several pieces of angle-iron material, reinforced by welding triangular gussets to the baseplates, which, in turn, are bolted to the bed of the jig.

Preparation of the tubular pieces for welding consists of placing them in such a position as to form a curved structure. Hinged clamps are then swung into place over the top rail and fixed side clamps held by means of springs are snapped into place around the side pieces. The illustration shows the fixture with a complete guard-rail assembly in position ready for the welding operation.



Tubular Pieces that Form Guard Rail for Gun-mount Platform Assembled in Fixture Ready for Welding



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Precision thread chasing is regularly done on a standard model Sidney Lathe without fuss or bother—at Consolidated Vultee as illustrated.

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This is only one typical example of how Sidney Lathes are meeting close tolerances throughout the aircraft and allied industries. Bulletins on all sizes of Sidney Lathes available.

Photo courtesy Consolidated Vultee Aircraft Corporation

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Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Consulting an Expert in Patent Developments

M. U. — A manufacturer runs across a problem and suggests a solution along a certain line. He consults an expert and solicits his co-operation. The expert finds the manufacturer's solution inoperative, but develops a proper solution of his own along the same lines. Who is entitled to the patent on the final solution?

Answered by Adelbert Schapp, Patent Attorney
San Francisco, Calif.

This question raised recently, came before the U. S. Court of Customs and Patent Appeals and was decided in favor of the expert. Since inventors usually feel that they may consult an expert for the development of an invention without losing control of it, this decision may give some food for reflection.

In the case referred to, the facts are well explained by some of the correspondence. The expert had on the market a certain polarizing material, and the manufacturer wrote to the expert as follows:

"Thank you for your letter of July 23, in which you offer the services of your laboratory in the solution of our problem. I believe it best to outline the situation in the hope that you may be of some assistance. One of the large railroads is using a special color signal system, with which they are having some difficulty from what is commonly known as 'phantom images.' This is caused by interference from sunlight; at certain times of the day, light rays enter the signal, which gives the signal the appearance of being lighted normally. It is my thought that the use of a polaroid screen will prevent some of this redirected light from illuminating the color filter. . . . If this idea is unsound or if you have already tried it in practice, please advise. As a lamp manufacturer, we have received this request to improve general lighting conditions. If the use of 'Polaroid' offers any improvement in the correction of this phantom image, I can assure you the field of application would be very large. Please treat this request as confidential."

The expert, manufacturer of "Polaroid," found, and the record subsequently showed, that "Polaroid" as then manufactured would not solve the problem, but "by the use of a form of 'Polaroid' somewhat different from our regular trade," he wrote, "it seems practically certain that the phantom images can be reduced to a considerable degree, perhaps completely."

Both parties filed patent applications on the use of the modified "Polaroid," the lamp maker claiming that he was the original inventor, that he disclosed the idea to the expert, that his suggestion of the use of "Polaroid" included the modified material, that the selection by the expert of the modified material involved nothing more than the ordinary skill expected of an expert, and that their confidential relationship entitled him to the benefit of the expert's development. The expert argued that the information given him by the manufacturer was not sufficient to solve the problem, and that the solution required the exercise of the inventive faculties rather than mere mechanical skill.

The Court held that it was the expert who finally solved the problem, that he was the original inventor, and that the manufacturer was not entitled to the benefit of the work performed and the success achieved by the expert. This decision seems to suggest that inventors should endeavor to solve their problems through their own efforts, and to consult an expert only on the basis of a clear previous understanding with regard to mutual rights.

* * *

Annual Meeting of Tool Engineers to be Held in Philadelphia

The annual meeting of the American Society of Tool Engineers will be held March 26 to 28 in Philadelphia, Pa., with headquarters at the Bellevue-Stratford Hotel. Technical sessions will be held in the forenoon, afternoon, and evening, Monday, March 27, and in the morning and afternoon Tuesday, March 28. The technical sessions have been compressed into two days in order to conserve time, since most of the tool engineers are unable to spare much time away from their work these days. The annual dinner will be given Tuesday evening.

In contrast to the custom of the last two years, no exhibition featuring machine and tool progress is scheduled this year. Plans are already being considered, however, for holding a large exposition of production equipment, tools, and machines after the termination of the war in Europe.

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Partial Contents

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Rake Angles—Bevel Angle—Chamfer or Radius—Face—Carbide Tip Thickness—Blade Thickness, etc.—How to compensate for possible speed and power limitations.

Correct Grades of Carboloy Cemented Carbide

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Special Work-Holding Clamps Increase Capacity of Boring Mill

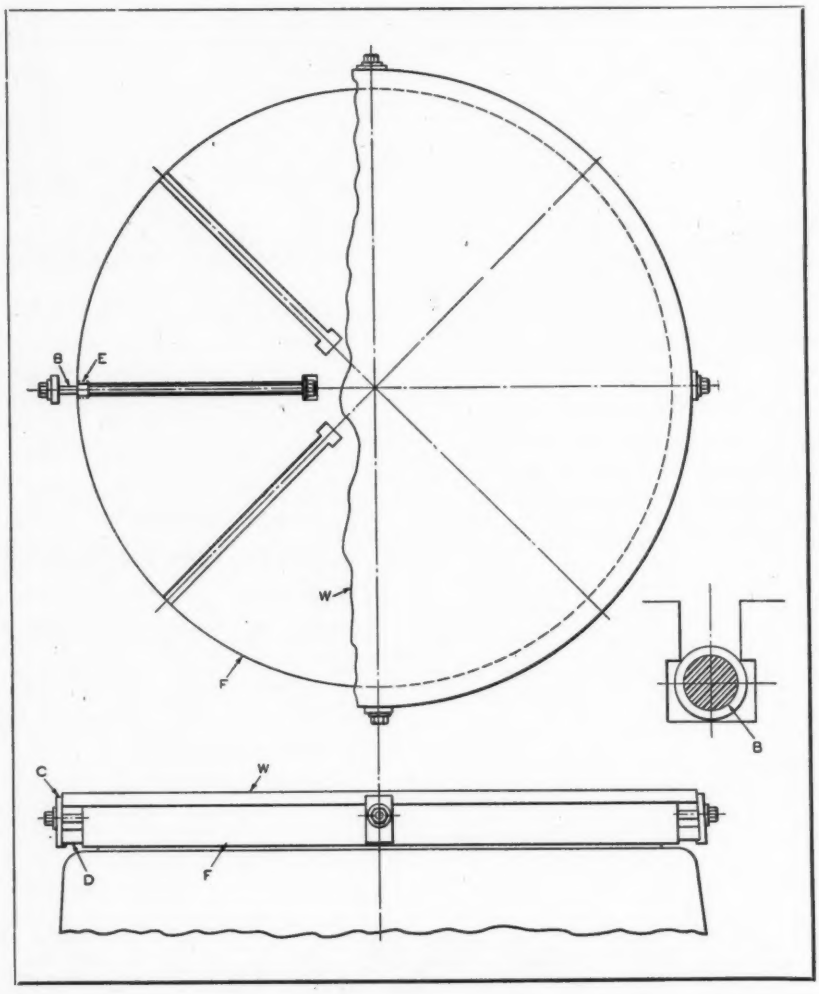
By HARRY A. SCHREIBER

The flat-disk condenser-head casting, 11 feet in diameter, shown at *W* in the accompanying illustration was required to be machined on a vertical boring mill that had a faceplate *F* only 10 feet in diameter. Thus the work could not be held by the standard jaws provided for the faceplate. To prevent springing when taking the heavy cuts required, it was necessary to have the work lie flat on the table or faceplate, with practically its entire surface supported.

To make up extensions that would permit the jaws to be used would involve considerable expense, and then there would still be danger of the work's springing. Entirely satisfactory means for holding the work *W* were provided by using bolts *B* in the T-slots of the faceplate, as shown, together with steel straps *C*, wood blocks *D*, and short collars or bushings *E* to hold the bolts in position.

* * *

Harry F. Byrd, United States Senator from Virginia, points out that, in the Office of Price Administration alone, the country's taxpayers have been supporting 2700 lawyers—500 of them in Washington to devise the regulations, and 2200 of them throughout the country to see that they regulate.



Set-up Used on Boring Mill to Hold Work 11 Feet in Diameter on a Faceplate 10 Feet in Diameter

How Industry Helps Win the War

The constant demand for still more ball bearings for war equipment might lead one to believe that the ball-bearing industry had not expanded as much proportionately as some other industrial branches. In view of this, it is of interest to note that, according to information obtained from the New Departure Division of General Motors, with main plants at Bristol, Conn., this company in the months of November and December, 1943, made more ball bearings than it produced during the entire four years of the first World War. This is an eloquent commentary on the ability of industry to expand to meet the present emergency.

* * *

Health Problems on the Production Front

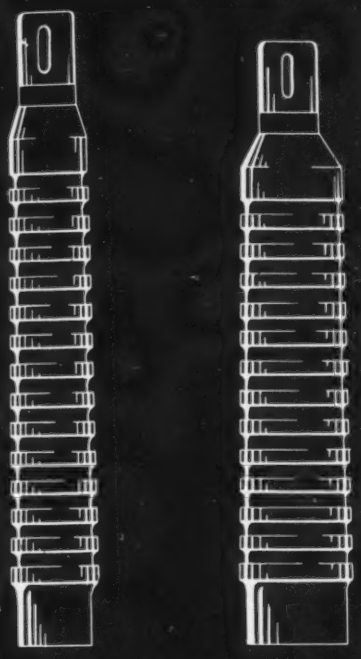
The National Association of Manufacturers has published a booklet entitled "Health on the Production Front," designed to serve as a guide in war production plants, both small and large. The book is the result of surveys and studies made of the health problems within the nation's factories during the past year. It sets forth the fundamental principles upon which a comprehensive industrial health program must be based, in war or in peace, and covers all phases of the subject. Those interested can obtain copies from the National Association of Manufacturers, 14 W. 49th St., New York 20, N. Y.

* * *

Alloy for Setting Diamonds in Tools

An alloy known as Permaloy, used for mounting or setting diamonds in tools for machining metals, has been placed on the market by E. Karelsen, Inc., 125 W. 45th St., New York 19, N. Y. The use of this alloy makes it possible to avoid subjecting the diamond to excessive heat in mounting. Further, the diamonds are said to be held rigidly for an indefinite period, irrespective of the heat produced when the tools are used.

BOTH these Broaches are the right length



1"	HOLE DIAM.	1½"
.030"	STOCK REMOVED	.040"
2"	EFFECT. LENGTH OF HOLE	2½"
0.375	CU. IN. PER STROKE	0.628

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BY USING CORRECT BROACH LENGTH

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If the broach is shorter than this, it usually means a bigger step per tooth and you may have to sharpen more frequently, you may have increased tooth breakage, or finish may be inadequate.

If the broach is too long you lose productive time without gaining anything.

The job of correctly calculating the proper length of a broach for any given job is not difficult but it does require the availability of empirical data on actual broach performance on similar applications, similar materials, etc.

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Broaches — Broaching Machines - Broaching Equipment

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

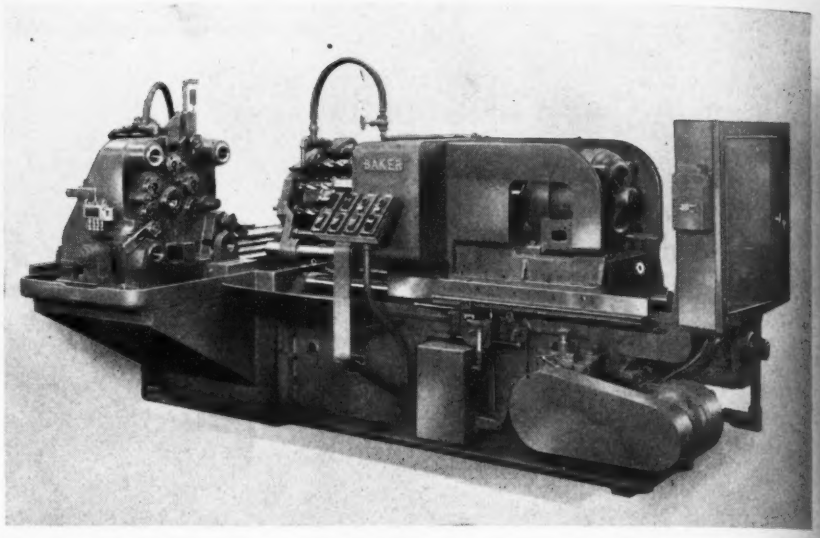

Fig. 1. Multiple-spindle Automatic Machine Developed by Baker Brothers for Drilling and Boring Magnesium Covers for Aircraft Engines

Baker Multiple-Spindle Automatic Drilling and Boring Machine

A horizontal, hydraulic-feed, multiple-spindle drilling, boring, and counterboring machine, designed for full-automatic cycle operation, has been developed by Baker Brothers, Inc., P.O. Box 101, Station F, Toledo 10, Ohio. This machine has been built to give rapid production and to maintain a high degree of accuracy with respect to spacing or dimensions between bores when operated by an unskilled workman.

The part handled on the machine illustrated is a magnesium cover for an aircraft engine. The bores and counterbores in this part are held to accurate limits on the diameter, and must be spaced in relation to each other within very close limits. The machine, as shown in Figs. 1 and 2, is equipped with special cross-indexed work-holding fixtures. The only part of this machine that is of standard design is the 3 1/2- by 24-inch horizontal hydraulic feed unit. The entire multiple-spindle head and drive on the top of the saddle and the end bed that carries the slide for moving the work-holding fixture were especially built for machining the engine cover.

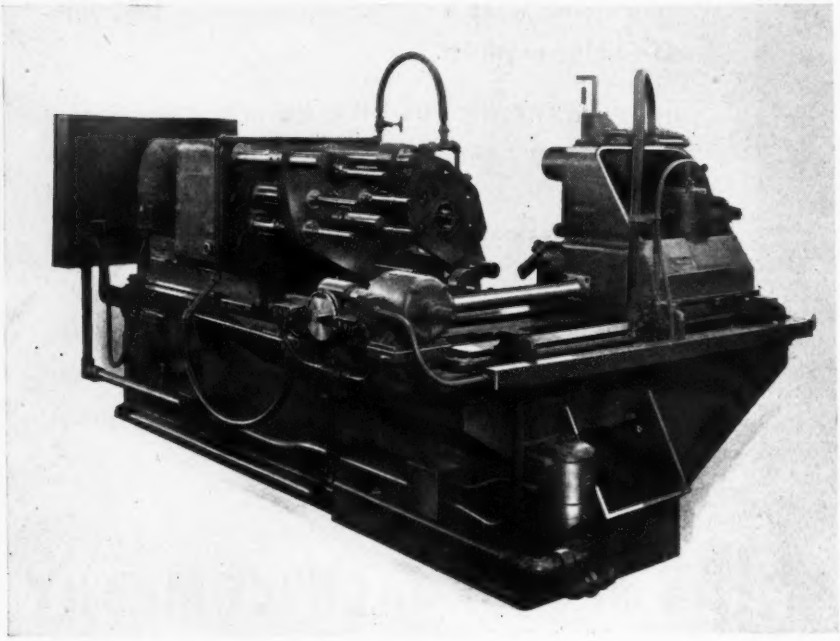

Fig. 2. Rear View of Baker Automatic-cycle, Hydraulic-feed Drilling and Boring Machine

The multiple-head unit carries fifteen spindles. There is a group of eight spindles at the front cutting station, which is used for drilling several of the holes from the solid and for rough-boring the large center hole. The seven spindles at the rear station are used for finish-boring and finish-counterboring.

Fig. 1 shows the work-holding fixture with support bushings mounted at the front to facilitate chucking the work. The push-buttons for controlling the machine are located close to the right hand of the operator. When the machine is in operation, it is only necessary

To obtain additional information on equipment described on this page, see lower part of page 178.

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GISHOLT

★ *Reproductions of this page on enameled paper are available for bulletin-board use in your turret lathe department. Write the Gisholt Machine Company, 1209 East Washington Avenue, Madison, Wisconsin. Ask for the series of "Wartime Care and Operation Posters." State quantity desired.*

to load and unload the work and push the button to start the operating cycle. As soon as the operator pushes the proper button, the work-holding fixture moves to the front cutting station; the multiple-spindle head unit then moves forward and performs the drilling operations. While the drills are in operation at the front station, the tools in the rear group of seven spindles are clear of the work.

After the first operation, the multiple head returns to the rear position, and the fixture indexes automatically to the rear position. When the second operations are being performed, the eight front spindle tools are running in the clear without cutting. After the operation at the rear position, the drilling unit returns automatically, and the fixture moves back to the original chucking position. 51

Landis Improved Plain Hydraulic Grinders

Important refinements have been incorporated in the 10- and 14-inch plain hydraulic grinders built by the Landis Tool Co., Waynesboro, Pa. These improved machines are designated Type CH. The demand for greater accuracy and better finish on many machine products without reducing the production rate has been responsible for practically all of the changes made in these machines. The wheel-feed mechanism, for example, has been completely redesigned. A large micrometer ring at the rear of the feed-up handwheel permits accurate setting for the desired amount of hand feed. Graduations on the ring are normally read in thousandths in terms of work-diameter reduction. By making a simple adjustment, these graduations can be read in ten-thousandths.

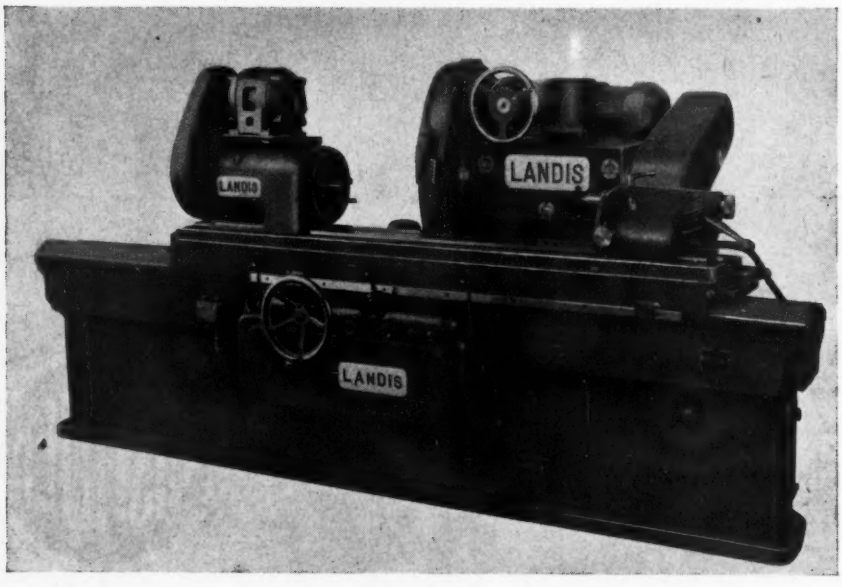
The automatic wheel feed previously furnished on power-traverse machines is built into the wheel-base of the improved grinders. It is automatically reset at the end of each grinding cycle without requiring the operator to change the position of the wheel-feed handwheel. This simplifies operation and eliminates spoiled work, should the operator neglect to reset the wheel when changing work.

The Landis hydraulic straight in-feed is supplied only on order, but when furnished, the automatic wheel-feed fixture is still retained. The stroke of the hydraulic straight in-feed is adjustable from 1 to 3 1/2 inches, and the slow feed is adjustable from 0 to 0.120 inch on the work diameter. A special hydraulic straight in-feed arrangement is available for use when cheek grinding, in which case the slow feed is adjustable from 0 to 1 inch. Variations in oil viscosity due to temperature changes are prevented from influencing the accuracy of the feed by an automatic compensating device.

Smooth rotation of the headstock faceplate is assured by the use of anti-friction bearings and a multiple V-belt drive. The headstock is much lower than the headstocks on previous machines, and is of very compact design. The ruggedness of the footstock has also been increased. A wheel-truing bar with micrometer adjustment can be built into the footstock base when desired. A hydraulically operated footstock with foot-pedal control can also be supplied on order. All electrical controls are completely enclosed.

Previously developed Landis features, such as the dual cylinder type hydraulic work-table, traversing mechanism, and microsphere wheel-spindle bearings, are incorporated in the Type CH machines. As in the case of the previous 10- and 14-inch machines, special equipment is available for handling parts having unusual shapes.

Both the 10- and 14-inch swing machines may be had in bed lengths of 18, 36, 48, 72, 96, and 120 inches. Machines with increased swings can be furnished for special work. The standard grinding wheel is 30 by 3 by 12 inches. The headstock is driven by a 1-H.P. constant-speed motor. The drive to the wheel is furnished by a 10- or a 15-H.P. constant-speed motor. The 10- by 36-inch machine weighs 10,800 pounds. 52



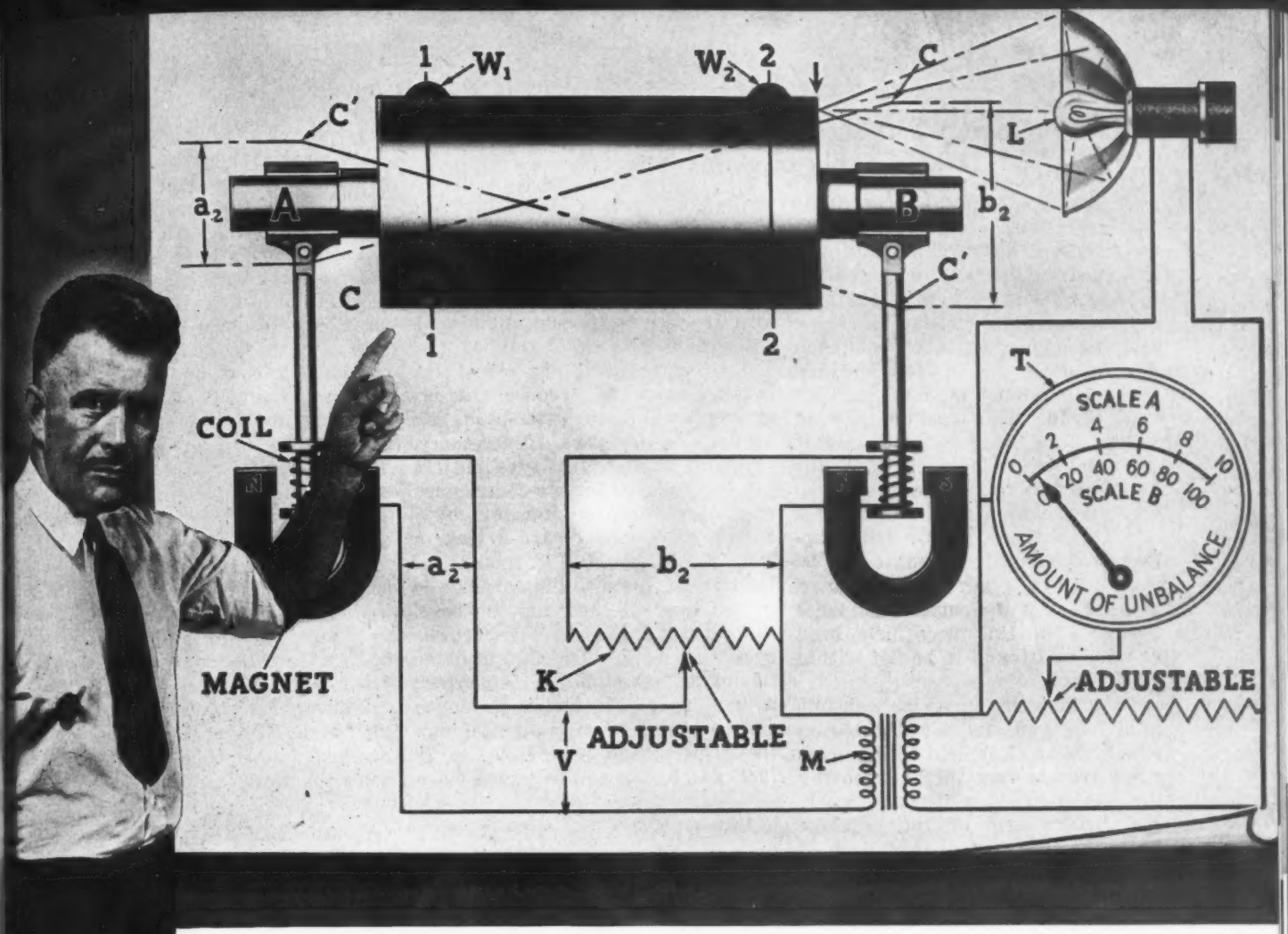
Landis Redesigned Plain Hydraulic Grinder

Lincoln General-Purpose Welding Electrode

A new general-purpose arc-welding electrode for welding mild steel in all positions, with either alternating or direct current, is announced by the Lincoln Electric Co., Cleveland 1, Ohio. This "Fleetweld 37" electrode is the most recent addition to the group of Fleetweld electrodes developed by this company for welding mild and low alloy steels. It was originally designed as an easy striking, smooth operating electrode intended primarily for light-gage material. Extensive use in production work has shown it to be a fast operating electrode under all conditions.

A remarkable feature of this electrode is that there is absolutely no slag interference in welding vertically downward, which is the position that gives the highest welding speeds on 8- to 16-gage steel. 53

To obtain additional information on equipment described on this page, see lower part of page 178.



Design for Living – *Longer*

IF YOU'RE an electrical engineer, you'll see in this schematic diagram how the Gisholt Dynetric Balancing Machine *locates* and *measures* unbalanced forces by electrical means. If you aren't, don't let it bother you. Because the machine itself is so simplified that anyone can operate it.

The important thing is the way it can assure longer life in high speed rotating parts by eliminating vibration. It enables you to make accurate balance a *part of design* for smoother, more dependable operation. And it provides the quick and efficient means of insuring it. If your product involves the use of armatures, crankshafts, impellers, fans, pulleys, other high speed rotating parts, learn how Dynetric Balancing can help you.

GISHOLT MACHINE COMPANY
1209 East Washington Avenue • Madison, Wisconsin

LOOK AHEAD... KEEP AHEAD...
WITH GISHOLT IMPROVEMENTS

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

Onsrud Milling Machine for Beveling Flat Aluminum-Alloy Sheets

A new type of high-speed milling machine, with two cutter-heads mounted on a traveling carriage, designed for the rapid and accurate milling of long, flat, bevel surfaces on aluminum-alloy aircraft wing and fuselage sheet stock, has been developed by the Onsrud Machine Works, Inc., 3940 Palmer St., Chicago 47, Ill. This machine is being used in one of America's largest aircraft plants for beveling the skin sheet sections of airplanes, so that they can be lapped to form a smooth surface. Bevels with surface widths up to 8 inches can be machined to a mirror finish in a single pass of the cutter. Surfaces produced in this way have been checked and found to be flat within 0.0001 inch.

Basically, this machine consists of a long bed and T-slot table on which the work is held while a carriage travels over the bed, moving the cutter-heads along the work. The bridge arm of the carriage holds the two cutter-heads, each of which can be tilted upward to an angle of 15 degrees.

Bevels can be milled by two different types of operations. For milling a constant or straight-line bevel, the work is set up on the table so that the bevel milled will be parallel to the direction in which the carriage travels. The bridge arm is at a 90-degree angle with the lengthwise axis of the bed.

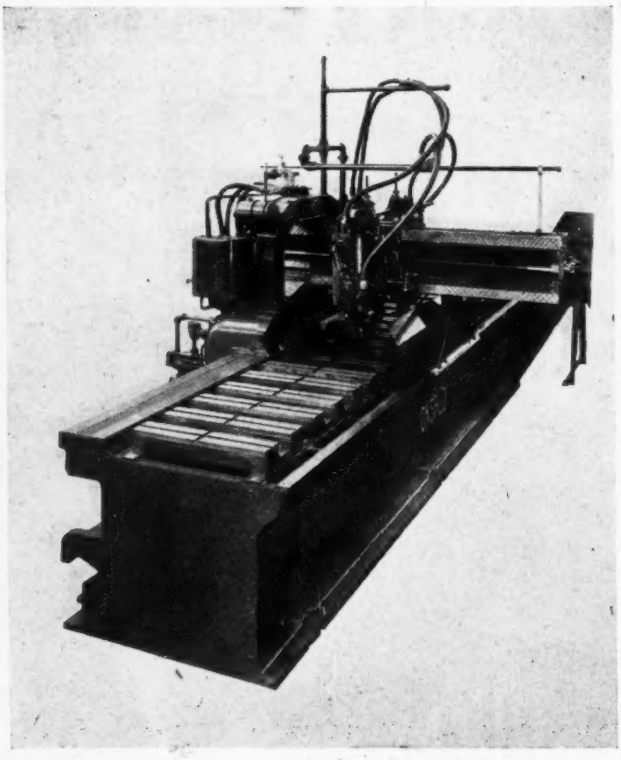
The cutter-heads are set at the correct angle to produce the required bevel. Both cutter-heads can be used in one pass, if necessary. End-mill type or fly type cutters can be employed for a recommended maximum working diameter of 8 inches. The cutters are driven at 3600 R.P.M. by 15-H.P. motors. In this type of set-up, the carriage is driven over the bed and the bevel is milled as the carriage travels over the work. On the machine illustrated, which has a 15-foot bed, a bevel up to 110 inches in length can be milled when one cutter motor is used, and a bevel up to 78 inches in length can be milled when the two cutter motors are used. Additional bed sections can be furnished to increase the capacity of the machine for beveling work up to any required length.

For milling a bevel surface on a taper or crosswise edge, the cutter-head is fed in a vertical or untilted position across the bridge arm. In this case, the work is held in a fixture which is clamped in a tilted position to give a bevel of the required angle. Bevels of this type can only be as long as the length of the motor travel across the bridge arm will permit, a travel of 30 inches being the maximum for a 90-degree crosswise edge, and somewhat less than this for the taper edge.

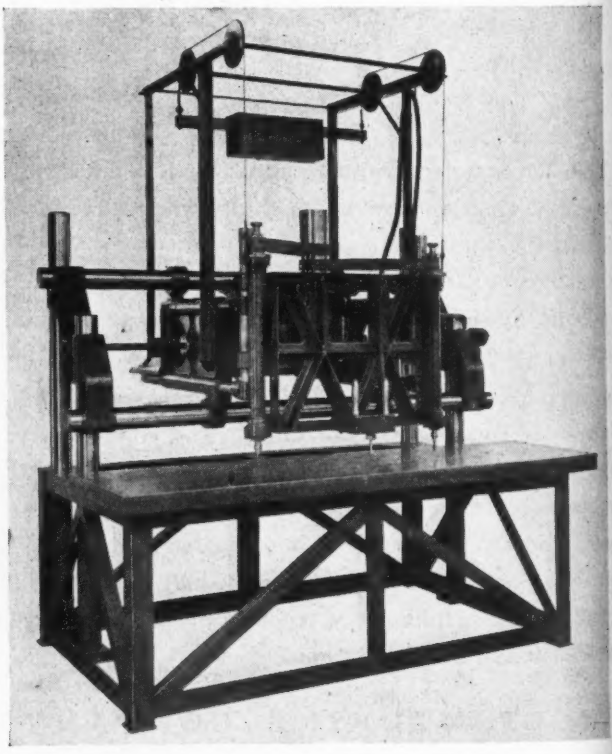
An important feature designed to give precision high-speed production is the centrifugal bearing preloader, which makes possible the 0.0001-inch machining accuracy of the vertical motor-driven end-milling cutters. A special vacuum chuck holds the work. 54

Century High-Speed Duplicating Machine

The Century Engineering Co., 816 W. Fifth St., Los Angeles, Calif., has developed a high-speed duplicating machine for the quick and accurate production of parts from forged stock. Two spindles,



Onsrud Milling Machine Designed for Beveling Flat Aluminum-alloy Sheets

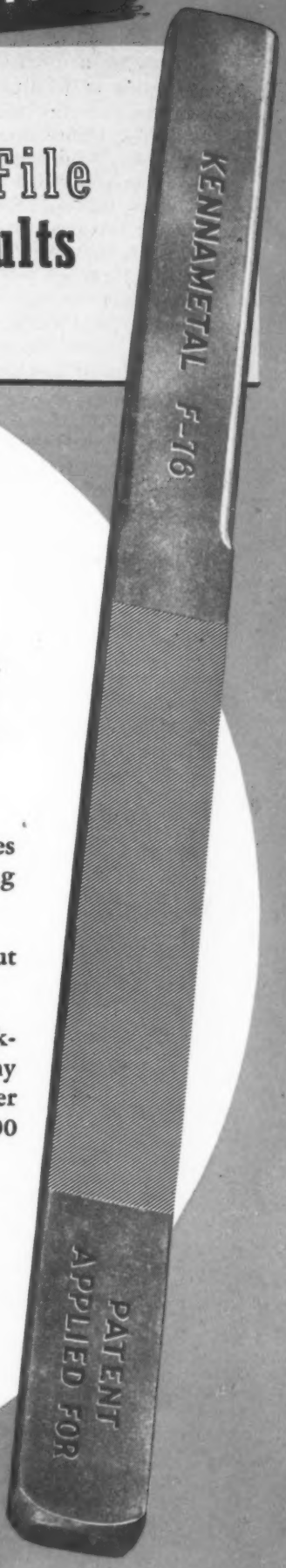


High-speed Duplicating Machine Developed by the Century Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 178.

ANOTHER KENNAMETAL FIRST!

New KENNAMETAL Lathe File Produces Sensational Results



One KENNAMETAL LATHE FILE removed the burrs from 100,000 shells as compared to 800 to 1,000 shells by a steel file—a production ratio of 100 to one!

Just as the introduction of KENNAMETAL-tipped milling cutters in 1939 is revolutionizing the milling of steel, the NEW KENNAMETAL LATHE FILE promises to establish new standards of efficiency and economy in the filing of steel and other metals. For example . . .

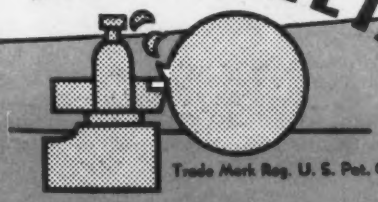
- ★ **KENNAMETAL Lathe Files permit filing speeds of 3 to 10 times that possible with steel files, matching the unusually high cutting speeds of KENNAMETAL carbide tools.**
- ★ **KENNAMETAL Lathe Files do not burn up at high speeds but outlast steel files 50 to 200 times.**
- ★ **KENNAMETAL Lathe Files cut hardened steels up to 62 Rockwell C which the ordinary file will not touch . . . do a noteworthy job on cast iron and brass at surface speeds around 900 feet per minute, and efficiently file high-carbon, high-chromium steels at 800 surface feet per minute.**

At present, KENNAMETAL LATHE FILES are available in one size—Style F-76, illustrated. It is 11" long, 3/4" wide, and 3/8" thick, having a substantial filing surface 4" long of grade K4H KENNAMETAL (80.6 Rockwell C), single cut with teeth at 30° shear angle, 40 per inch. Shank is shaped for convenient handling.

PRICES—1 to 9 files . . $15.00 each
10 to 99 files . 13.00 each
100 or more . 12.50 each
F.O.B. Latrobe, Penna.

You too can save time and reduce costs with KENNAMETAL Files. Order one today and prove its merits for yourself.

KENNAMETAL

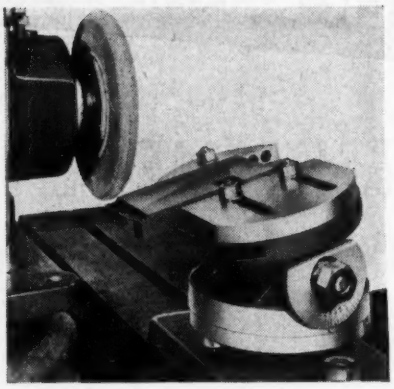


Trade Mark Reg. U. S. Pat. Off.

KENNAMETAL *Inc.*
147 LLOYD AVE., LATROBE, PA.

SUPERIOR CEMENTED CARBIDES

with a speed of 10,000 R.P.M., are driven by a 10-H.P. motor. The operation or feeding movements of the tools in the vertical and fore and aft planes are accomplished manually, while longitudinal movement is controlled by buttons located at the top of each of the operating handles. By means of these controls, the carriage can be moved to the right or left to enable the operator to determine the amount of cut. This machine does not require a skilled operator, and it can be easily and quickly set up.....55



Universal Chaser-grinding Fixture Made by Oster Mfg. Co.

Oster Chaser-Grinding Fixture

A new universal chaser-grinding fixture has been introduced to the trade by the Oster Mfg. Co., 2073 E. 61st St., Cleveland 3, Ohio. This fixture is designed for easy mounting on the table of conventional tool- and cutter-grinding machines, and is adjustable for any throat or rake angle desired. It will hold all sizes, makes, and types of dies or chasers. The fixture is 5 1/2 by 5 1/2 by 9 inches in size, and weighs 25 pounds. 56

Shields Boring Mill with Push-Button Control

Stepless variation of all speeds and feeds by means of push-button control is an outstanding feature of a new boring machine brought out by the Shields Mfg. Co., 38-09 24th St., Long Island City, N. Y. The changes in speeds and feeds can be made during a cut or while the machine is stopped. When a large surface is being faced, for example, the operator can change the spindle speed of the facing head to compensate for the gradually changing cutting diameter without stopping or interrupting the cut. He can also slow up the feed smoothly when the cutter encounters a heavy casting section or speed up the feed when the cut becomes lighter.

To adjust a speed or feed, the operator simply presses a button on a movable pendent. Provision is also made for manual adjustment. The exact speed and feed can be easily read on one of the three direct reading dials. These advantages have been made possible through the application of three Reeves drives consisting of a motor-driven unit mounted directly on the head for obtaining the spindle speeds; a "moto-drive" for the spindle feeds; and a third drive for all other feeds. The use of stepless variable-speed drives not only provides improved operation, but also simplifies the machine itself; it has almost cut in half the number of gears, shafts, and operating levers required.

Directional control is provided for all feed and rapid-traverse movements. These controls are arranged to provide the utmost safety for the operator. The control levers have slotted portions that

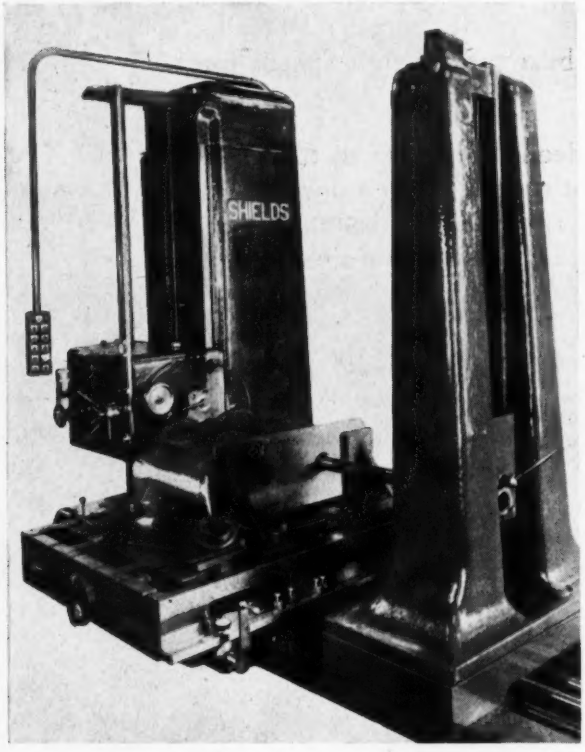


Fig. 1. Boring Mill Brought out by the Shields Mfg. Co.

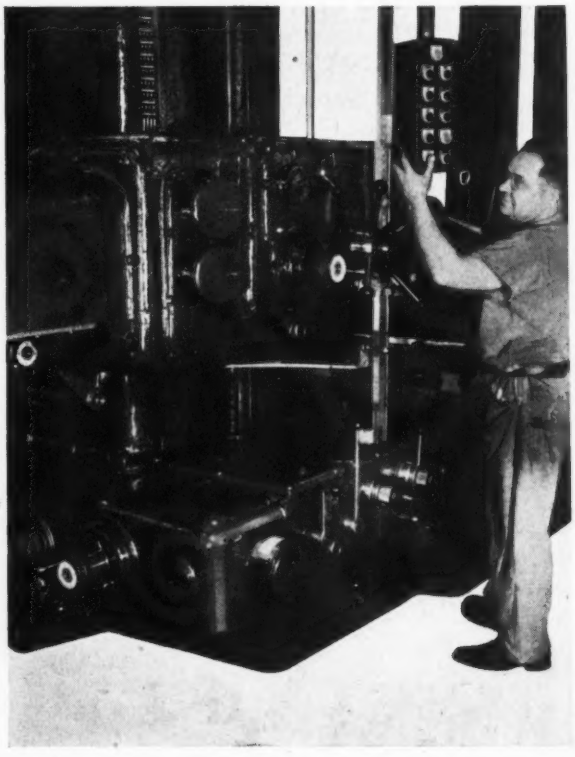


Fig. 2. Close-up View of Boring Mill Head and Push-button Control

To obtain additional information on equipment described on this page, see lower part of page 178.

Ex-Cell-O machine illustrated is an opposed Style 58 two-way machine arranged with six boring spindles at each end for finish boring, counterboring and facing the gear holes in an aluminum supercharger cover. All spindles operate simultaneously, finishing the holes within .0005" at a highly satisfactory production rate. The units have 20 inches of table travel and 15¾ inches between the ways. Each spindle is individually adjustable for quick setting. In this particular application all centers are set to a master gage, which, in effect, is a master for the part itself.

INCREASING PRODUCTION . . .

with new economy!

Ex-Cell-O Unit-type Precision Boring Machines Bring Added Practical Features

Ex-Cell-O has developed standard boring units, each a complete machine in itself, yet by means of heavy flanges and bolts these units can be bolted singly or in multiples to a stationary center section, resulting in a multiple precision boring machine. Note these advantages:

It is still a *precision* boring machine. Bores may be finished in tenths of thousands as before, yet units may be mounted in multiples and at angles, all operating simultaneously toward the center section.

Because all units may operate simultaneously, production is considerably increased on many parts.

The unit-type construction allows for salvage of all but the fixtures in case of part changes. It is possible and economical merely to remove and replace the entire center section. This means a flexible machine on which maximum production can be obtained while the machine is set up.

Each way or unit has two feeds and a dwell in forward and reverse direction, and each can be controlled individually or by a central control button in conjunction with all other units hooked into the electrical panel. It is completely automatic except for loading and unloading.

More than most semi-special machines, this Ex-Cell-O machine incorporates desirable features in flexibility and production, for war work today and peacetime products tomorrow.

EX-CELL-O CORPORATION • DETROIT 6, MICH

Ex-Cell-O has just printed a new folder on Unit-type and other Way Machines. A copy is yours for the asking. Send to Ex-Cell-O Corporation, Detroit 6, Michigan, and specify Bulletin 31631.

PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES BROACHES • GRINDING SPINDLES • HYDRAULIC POWER UNITS • DRILL JIG BUSHINGS TOOL GRINDERS • CONTINENTAL CUTTING TOOLS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

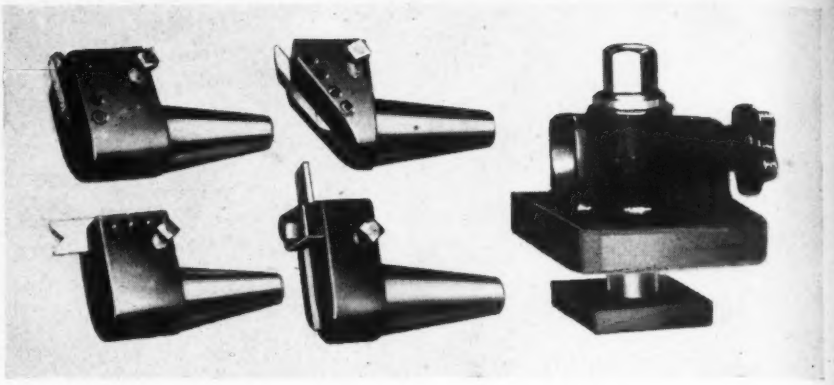
are so arranged as to make it impossible to engage a hand-crank and at the same time apply power feed or rapid traverse. Also, power feed cannot be applied to a member when the member is clamped. Torque motors can be provided for power clamping.

The boring-bar is 4 inches in diameter, and has a feed of 60 inches, available in two steps. The head feed is 72 inches, and the saddle feed 60 inches. The table has a working surface of 48 by 84 inches, and a feed of 72 inches. The complete machine weighs 42,000 pounds. 57

Davey Portable Dynamic Balancing Equipment

The Davey portable balancing equipment, brought out by the Vibroscope Co., 6 E. 39th St., New York 16, N. Y., for the dynamic balancing of machine parts of all sizes in their own bearings or in bearings built for the purpose, is now supplied with a vibrometer which measures vibration amplitude directly, and a stroboscope which gives a direct visual reading of the "high spot" or phase angle.

A new feature of this equipment is a remote-control switch mounted on the vibrometer, which places the entire operation in the hands of a single man instead of requiring an assistant to make adjustments, as in earlier models. This equipment is available in two models, weighing 22 and 25 pounds, complete with cases and batteries. 58



Quick-change Lathe Tools Made by Kyle-Johnson Machine Co.

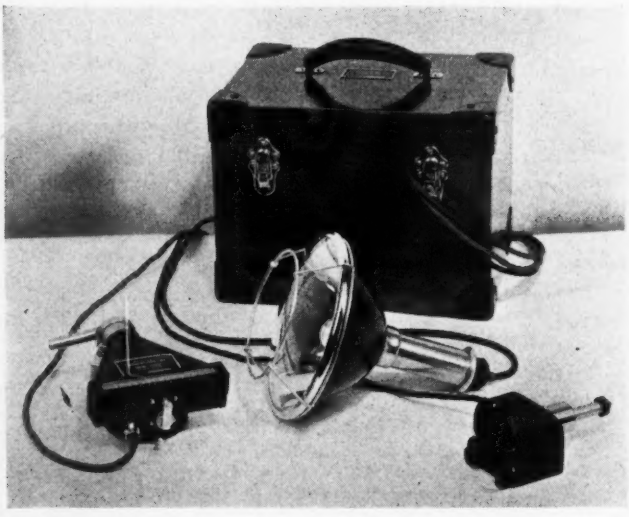
K-J Quick-Change Lathe Tools

A line of K-J quick-change lathe tools designed to simplify engine lathe tooling is being manufactured by the Kyle-Johnson Machine Co., 1627 W. Pico St., Los Angeles, Calif. These tools can be easily changed to suit different kinds of machining operations without the use of wrenches. Changing of the tools from one operation to another or from lathe to lathe can be readily accomplished without affecting the accuracy of the tool height adjustment. Only a few seconds is required for changing a tool. Two turns of the draw-screw lock serves to release the tool, which can then be removed and replaced. The tool used to replace the one removed can be slipped into a special non-binding tapered recess, and quickly drawn into its working position and rigidly secured.

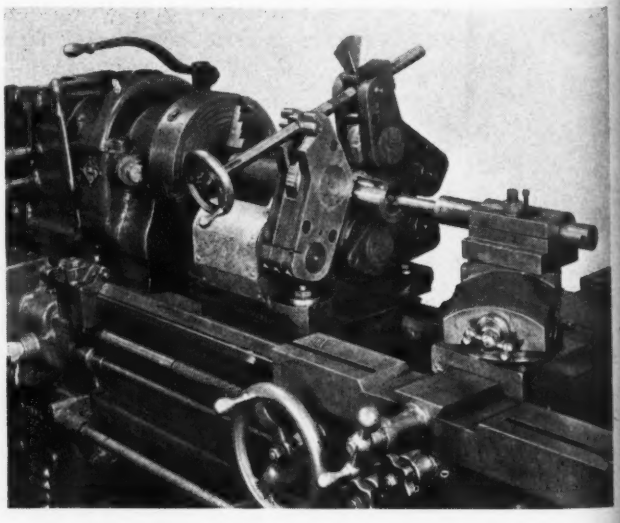
Drilling is facilitated by using the machine feed. Threading, turning, or alternative operations in any combination arrangement can be performed at the will of the operator. Side forming is easily accomplished, since the K-J toolholder is rigid and has no excess overhang. The holder will accommodate boring-bars in sizes ranging from 1/4 to 1 inch. The accurate height adjustment and minimum amount of overhang serve to simplify cutting-off operations. Other K-J tools are available for straight forming and box turning. 59

Self-Centering Roller Steadyrest

The Charles Stecher Co., 2452 N. Greenview Ave., Chicago 14, Ill., has placed on the market a heavy-



Davey Portable Balancing Equipment Brought out by the Vibroscope Co.



Stecher Self-centering Steadyrest for Second-operation Work

To obtain additional information on equipment described on this page, see lower part of page 178.

TOOLS WORK TWO EXTRA SHIFTS PER WEEK

SUNOCO
EMULSIFYING CUTTING OIL

increases tool life 35% . . . improves finish . . . at war plant

Machine tool men looking for ways to effect tool economies will find this case history valuable. It's about a plant producing armament parts, and how they increased tool life the equivalent of two extra 8-hour shifts in every 48-hour week.

Production was slowed because of trouble on machines using a competitive soluble cutting oil. Tool casualties ran high, finish of parts was inferior, emulsions showed a tendency toward rancidity.

Trouble stopped when they changed to Sunoco Emulsifying Cutting Oil upon the advice of a Sun Oil Engineer. Tool life increased 35% . . . finish was noticeably finer . . . rancidity stopped. And in addition, cutting oil costs were cut.

Now parts are speeded from the machines of this plant . . . and from hundreds of other plants that have found Sunoco Emulsifying Cutting Oil a spur to machine tool output. Sunoco's exceptional heat-absorbing quality and stability make it the answer for all metal cutting operations where a soluble oil is used.

For advice on cutting oil problems, write

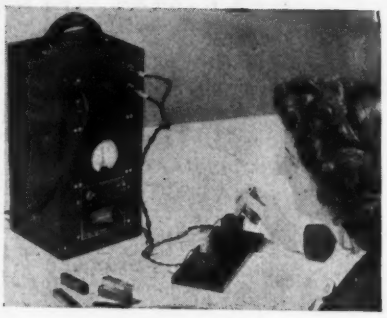
SUN OIL COMPANY · Philadelphia 3, Pa.
Sun Oil Company, Ltd., Toronto, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS *HELPING INDUSTRY HELP AMERICA*

duty, self-centering steadyrest especially developed for second-operation work on parts such as propeller shafts and other airplane equipment requiring end machining operations on either engine or turret lathes. The hand-operated model illustrated is intended for mounting directly on the ways of a 22-inch lathe. It has a capacity of from 1 1/2 to 9 inches. An air-operated model, designed with a bracket for mounting on the back of a heavy-duty turret lathe, to allow clearance in front for the side turret, is also available.

Hardened steel rollers with heavy-duty Timken bearings are carried in the three interlocking arms, which provide rigid and accurate support for cylindrical parts. The clamping screw is provided with spring tension and a dial indicator to insure uniform pressure on pieces that may vary slightly in diameter. 60



Magnetic Comparator Developed by the General Electric Co.

General Electric Magnetic Comparator

A new magnetic comparator for controlling the quality of ferrous metal parts that must be alike in size and shape within very close limits has been brought out by the Special Products Division of the General Electric Co., Schenectady, N. Y. When the part to be tested is placed in a coil which has been balanced electrically against a standard part, the new comparator detects any difference in the two parts that is sufficient to change the magnetic flux linking the coils surrounding them. The differences detected may be caused by incorrect composition, improper heat-treatment or hardness, incorrect size, or other properties that affect the magnetic flux in the coil. The difference is shown as unbalance on the comparator's indicating instrument, which reads within passing limits when the tested part is acceptable.

The comparator is sufficiently sensitive to distinguish between steels whose hardness varies as little as two points Rockwell when hardness difference is the sole variable. It is particularly designed for use in the fabrication of iron or steel parts when a non-destructive test is required to make certain that each part has the necessary properties.

The comparator consists of a variable-voltage transformer, a sensitivity control rheostat, coarse and fine balance control rheostats, and the required capacitors—all mounted in a portable steel case. The zero-center indicating instrument, control knobs, and switches are located on the front of the panel.

The test fixtures furnished with the magnetic comparator consist essentially of two air-core coils; but where surface conditions permit and the parts are too large for suitable coils, two gage-heads can be furnished for contact measurements. These fixtures are interchangeable, and both are equipped with flexible leads and connectors. The coils are available in a variety of sizes. 61

Wales-Strippit System for Punching Holes in Flat Material

The Wales-Strippit Corporation, 345 Payne Ave., North Tonawanda, N. Y., has recently developed new methods and equipment for punching holes arranged in any desired pattern in sheet material up to 43 by 45 inches in size. This new method, known as the Wales plate set system, consists of using Walesite plate sets and Wales PS punch assemblies and dies to form self-contained punching units that are ready for use as soon as they are placed in the press. Since the punching units are not attached to the press ram, they are readily interchangeable, and thus permit changing from one punching job to another with a minimum amount of lost time.

The first step in making one of these punch and die units, such as that shown in Fig. 3 for piercing the accurately spaced holes in the edge of a sheet or blank, is to provide a master templet for locating the punch centers on the top plate of the Walesite plate set. This set consists of two plates of Walesite, which is a plastic material especially adapted for the purpose. The two plastic plates are separated by spacer bars of the same material and are held together rigidly by bolts and dowel-pins. The plate sets are made in forty-eight sizes.

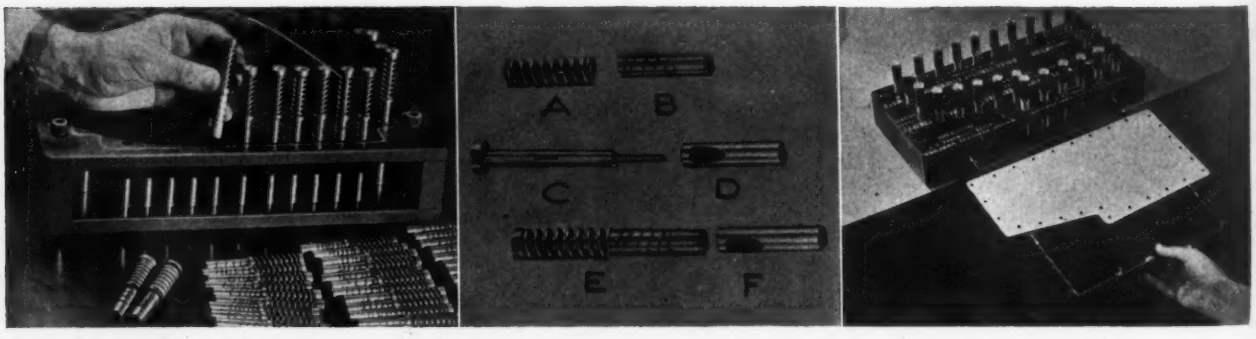
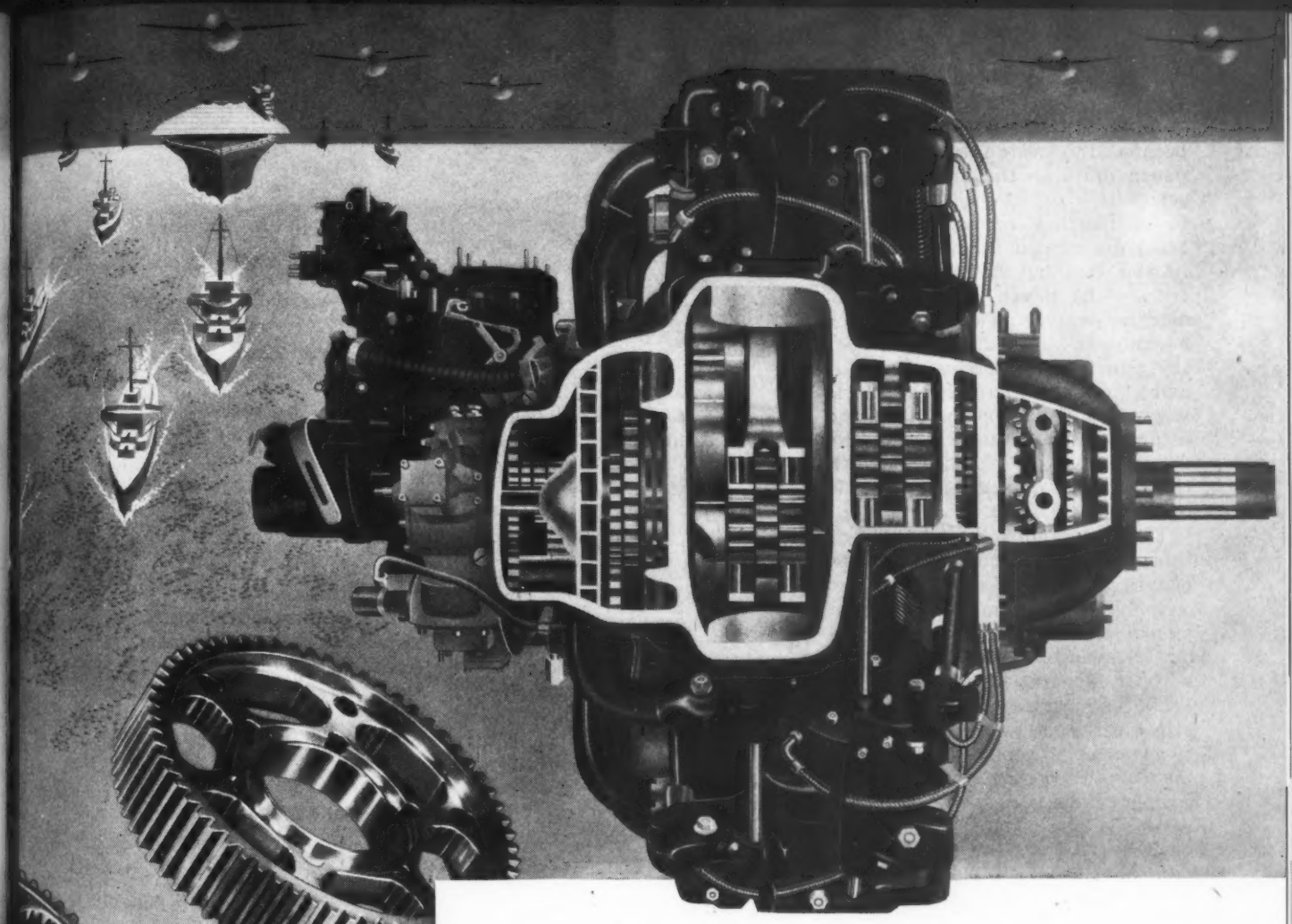


Fig. 1. (Left) Inserting Wales Punch Assembly in Top of Walesite Plate Set. Fig. 2. (Center) Stripping Spring A, and Guide, Lifting Spring B, and Punch C, Comprising Punch Assembly E, which with Die D, is Assembled in Plate Set Such as Shown in Fig. 1. Fig. 3. (Right) Plate Set Punching Die, Showing Work-feeding Carriage

To obtain additional information on equipment described on this page, see lower part of page 178.



Tomorrow's Gears Proved in Today's Laboratory . . .

EVER look inside a Twin Wasp engine? Here the power of 1200 horses is packed in a space no wider than your outstretched arms.

And notice the gears in this mighty engine—gears so compact and necessarily so light in weight that only extreme precision makes it possible for them to carry their tremendous load.

In the three precision gear plants of Foote Bros. new manufacturing methods, new technical developments plus the skill and "know how" of Foote Bros., engineers are today producing these high precision gears in amazing quantities. Outstanding developments in heat-treating and carburizing—an exact metallurgical control—the latest improvements in gear checking instruments—all these plus the skill and knowledge of a force of experienced men and women numbering more than 6,000 assure volume production of these metallurgically and dimensionally perfect gears.

Tomorrow when victory is ours, the precision gear production achieved in the plants of Foote Bros. promises American manufacturers a new economy in the transmission of power. For in compact speed reducers and aircraft devices—in marine motors and gear trains as well as in Pratt and Whitney engines, these precision gears are today showing the way to new standards in engineering which may be devoted to peacetime production when the war is won.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago 9, Illinois

ARMY E NAVY

FOOTE BROS.

Better Power Transmission Through Better Gears

After the master templet has been used to locate the holes for the punch units on the top plate of a set of the correct size for the job to be handled, accurately aligned holes are drilled in one operation in the top and bottom plates to receive the punch assemblies and dies, respectively. The entire punch assembly *E*, Fig. 2, consisting of the punch *C*, stripping spring *A* and guide, and lifting spring *B*, is inserted in the top plate in the manner indicated in Fig. 1. The die *D*, shown also at *F* in line with the assembled punch, is a press fit in the bottom plate.

The outstanding advantage of this system is the quick, easy manner in which an entire plate set assembly, with automatically aligned punches and dies, can be made without reference to or interference with the operation of the press. While one plate assembly is operating in the press, another one can be made up to replace immediately the one in operation when it has completed its run. A third press assembly, for example, can also be made by using a third plate set and re-using the punch assemblies and dies from the first plate assembly. Thus, the punch, assemblies, and dies are kept in continuous operation, and can, of course, be replaced without disturbing the set-ups.

The adjustable feed carriage shown in Fig. 3 is designed to permit the work to be quickly, accurately, and safely nested in the die and to be removed from it after the punching operation. With this feeding arrangement, the operator's hands do not touch the die. In actual use, the feed carriage is pulled out only far enough to permit changing blanks. 62

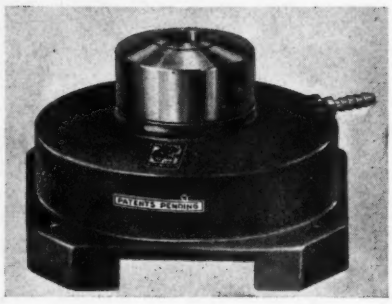


Fig. 1. Mead Pneumatic Collet Fixture with Fixed Depth Stops

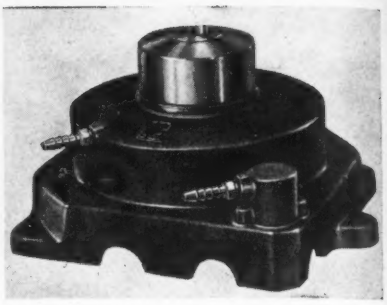


Fig. 2. Mead Pneumatic Collet Fixture with Automatic Work Ejector

Mead Pneumatic Collet Fixtures

The Mead Specialties Co., Division of Mead Gliders, 15 S. Market St., Chicago, Ill., has just added to its line four pneumatic collet fixtures. Two of the new models, LS1 and LS2, Fig. 1, use standard drawin collet 5C having a capacity for holding 1-inch round, 7/8-inch hexagonal, and 23/32-inch square, bars. These fixtures have an over-all height of 4 1/4 inches, and a diameter at the base of 8 inches. The clamping tension on the collet is twenty-five times the pressure in the air line. Insertion and removal of the work are accomplished manually. The hollow ram permits the depth-stop bar to rest on the machine table, thus assuring uniformity of the work. The Model ON control valve included with this fixture is designed for foot or automatic operation.

The Model LS1 fixture is designed for "dry" work, while Model LS2 is of the fountain type, with an inlet at the bottom to permit coolant to flow up through the collet slots and thus wash away chips, as well as lubricate the work.

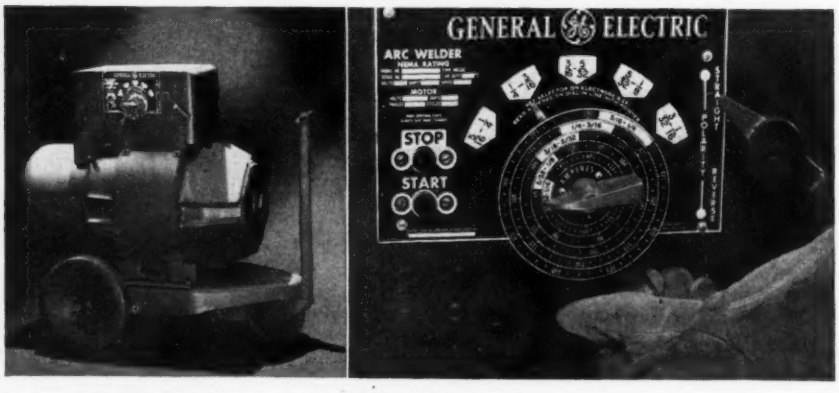
The other two models, LS3 and LS4, Fig. 2, are of the same design as the LS1 and LS2, except that the special base contains a mechanism for ejecting the work by raising the depth-stop bar after each operation. The over-all height of these fixtures is 5 1/8 inches, and the base is 8 by 8 inches. 63

Improved G-E Direct-Current Arc-Welders

Improvements have recently been incorporated in the line of direct-current, single-operator arc-welders of the Type WD-30 series, made by the Electric Welding Division of the General Electric Co., Schenectady, N. Y. In addition to retaining all the desirable features of this line, the improved welders are now equipped with two new control dials and a redesigned driving motor. The control dials permit the welding current to be pre-set without the aid of a voltmeter. The driving motor has also been designed to give exceptional resistance to the weather when the machine is operated outdoors.

One of the control dials is calibrated in terms of electrode size. The operator simply sets this dial to correspond with the size of the electrode being used. The other dial indicates the range of welding current available for use under these conditions. The operator makes a setting for the direct welding current by merely rotating a pointer to whatever amperage he desires to use. Clear, easily read calibrations facilitate quick, accurate operation of both dials.

While basically the driving motor



(Left) General Electric Portable Motor-generator Arc-welder Designed for One-man Operation. (Right) Close-up View of Electrode Selector and Amperage Control Dial of Welder Shown at Left

To obtain additional information on equipment described on this page, see lower part of page 178.

CONTINENTAL OXIDATION

(48 Hours at 341° F.—Iron Wire Catalyst—Air Rate 10 liters per hour)

	Oil "A"	Oil "B"	Oil "C"	HYDRO-DRIVE MIH-20
Original Viscosity @ 210° F.	49.9	50.3	51.6	56.3
Final Viscosity @ 210° F.	58.4	57.9	59.4	63.9
* % Increase in Viscosity	17.0	15.0	15.1	13.5
Final Carbon Residue	1.58	1.71	1.95	1.83
Final Neutralization No. (Acid)	1.35	1.4	1.52	0.8
**Naphtha Insolubles:				
Hours for 10 mgs.	32	14.5	15.6	48+
Hours for 100 mgs.	48+	48+	42	48+
Final Insolubles—mgs.	41	61.9	135	7.0
Transparency:				
Original	200	200	200	200
Final	110	130	90	160

** This line denotes comparative rate of thickening of oil in service.*

*** This value indicates expected sludge and gum formations in actual service in a hydraulic system.*

TESTS POINT OUT WHY

EXCELS AS A HYDRAULIC OIL

Test results, obtained from an outside source interested in evaluating hydraulic oils, bear out our claims for the superiority of Houghton's Hydro-Drive Series.

The Continental Oxidation accelerated test was run on three competitive hydraulic oils, against Hydro-Drive MIH-20. Those three are regarded as good oils, recommended by their makers for hydraulic use.

This test subjects each oil to 48 hours' exposure at 341° F. It uses an iron wire catalyst and bubbles air through the oil at the rate of 10 liters an hour. Thus it provides a stepped-up condition similar to that in a hydraulic system where air and metal are present.

Examine the test figures on this page. They're important. They prove the merits set forth for Hydro-Drive — treated to hold gums and resins in solution, provide stability and high Viscosity Index.

Note that there was less increase in viscosity as compared to the other oils, proving that Hydro-Drive has a higher Viscosity Index.

Note also that only 7 mg. of naphtha insolubles were measured for Hydro-Drive after 48 hours' test, compared to 41, 61.9 and 135 for Oils "A", "B" and "C" respectively.

Both by test and by actual plant run, Hydro-Drive wins. Try it and be convinced. Write for full information.

E. F. HOUGHTON & CO.

303 WEST LEHIGH AVENUE, PHILADELPHIA 33, PA.

Sales and Service in all Principal Cities

is the same as that previously furnished with these welders, it is equipped with heavier insulation. Accelerated life tests show that the new insulation is far more resistant to deterioration from salt spray than any of the insulation materials previously employed. 64

Peerless Improved Metal-Cutting Machines

The Peerless Machine Co., 1600 Junction Ave., Racine, Wis., has brought out a line of improved metal-cutting power saws of streamline design in which a new hydraulic unit has been incorporated. These new machines are equipped with a hydraulic micro-set length gage mounted on the conveyor for accurately gaging the length of cut, and a vernier screw control for adjusting the feeding pressure. The oil capacity of the feed unit of these improved machines has been increased 75 per cent.

The four-sided saw frame, which completely surrounds the blade and work, is a distinctive feature of these machines. Of special interest is the backing-plate blade support, designed to permit the application of maximum feeding pressure with minimum strain on the blade. The eight bearings on which the saw frame and guide travel have also been enlarged and have ground and removable inserts.

The saw frame is balanced in its reciprocating travel by dual hydraulic cylinders, and has the driving force applied centrally. The chip capacity has been increased 60 per cent. The 7- and 11-inch automatic models can be converted for handling a single bar or a nest of bars or tubes. 65

Lever Type "Speedichuk"

The General Die-Stamping-Tool Co., 265 Canal St., New York 13, N. Y., has brought out a lever type "Speedichuk" which not only increases the collet capacity of 1/2-inch lathes to 3/4 inch, but also allows the work to be chucked, fed, machined, and released without stopping the lathe spindle. This production collet attachment is designed to respond to the slightest pressure. The ease with which it can be locked or unlocked makes it particularly adaptable for use by women operators.

The chuck is made to fit such lathes as the 10-inch Atlas, Logan, 9-inch South Bend, and 12-inch Clausing and Craftsman, as well as other 1 1/2-inch by eight-thread spindle lathes that have a No. 3 Morse taper in the end of the spindle. Installation of this chuck requires no drilling or tapping operations. It is ready for instant use, and is interchangeable on any lathe having a spindle of the size given. The floating closing sleeve compensates for any misalignment of the chuck with the lathe spindle. Hardened rollers reduce friction to a minimum. All parts are hardened and ground.

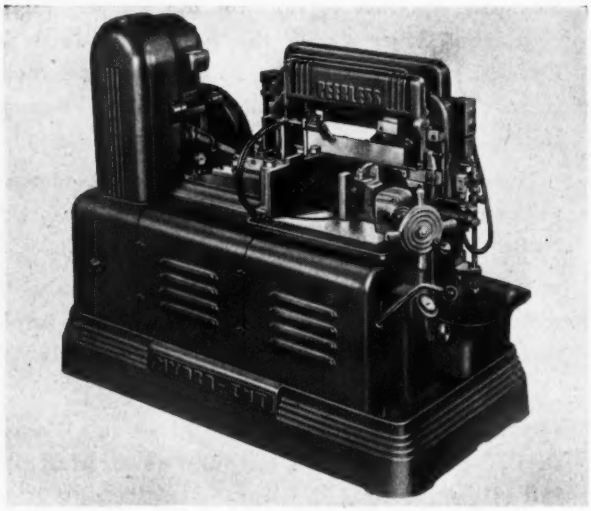
This Speedichuk is designed and built for use with the Bren collet,

Lever Type "Speedichuk" Made by General Die-Stamping-Tool Co.

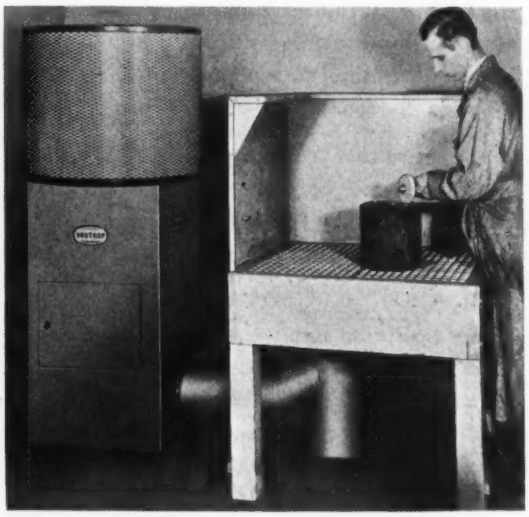
the body of which has a No. 3 Morse taper for mounting firmly in the lathe spindle. The chuck is closed by a squeezing action without longitudinal movement. This feature facilitates attaining a high degree of accuracy in cutting-off and forming operations. 66

"Benchkop" Self-Contained Dust-Collecting Unit

A portable, self-contained unit for collecting dust, lint, and dirt from flexible-shaft grinding and polishing operations, has been added to the line of equipment made by the Aget-Detroit Co., 602 First National Bldg., Ann Arbor, Mich. Dust and lint drawn down through the 1000-pound capacity removable wood grill first meet a horizontal baffle, which catches the heavier pieces of work, as well as any tools that may have dropped through the



Improved Metal-sawing Machine Made by the Peerless Machine Co.



"Benchkop" Dust-collecting Unit Brought out by the Aget-Detroit Co.

To obtain additional information on equipment described on this page, see lower part of page 178.

grill. The heavier dust and dirt drop down through the funnel to the bottom of the stack, to be removed through a hand-hole clean-out, while the lighter dust enters the inlet of the "Dustkop" through the connecting pipe. The dust and dirt separated by the cyclone separator drop into a glass storage jar, while the cleaned air passes through a filter and recirculates throughout the working space. This arrangement results in a considerable saving in heat. 67

Calder Grinding Wheel Dressers

A new line of diamond grinding wheel dressers has been announced by the Calder Mfg. Co., 628 N. Prince St., Lancaster, Pa. The new line will be known as "Ga" diamond dressing tools, the "Ga" indicating that the tools are guaranteed to give satisfactory service. These tools are available in all sizes and types of nibs for any kind of diamond dressing requirements. The company also announces a new line of diamond hand tools. These are available in six sizes, numbered from 1 to 6, inclusive. 68

Rotary Tables, Measuring Rods, and Indicators for Tool-Room Work

A precision 12-inch rotary table, measuring rods, and indicators for accurate positioning of work on "Index Mills" have been developed by the Index Machine & Tool Co. and are being introduced on the market by Blank & Buxton Machinery Co., 3100 E. Michigan Ave., Jackson, Mich.

The tool-room rotary table, shown in Fig. 1, has a ball type main bearing; quick-acting worm throw-out or disengaging device; single-motion positive table lock, designed to maintain accurate alignment of the table; coolant trough cast in the base; and hardened and ground worm.

With the measuring rods, indicators, and micrometer heads shown in Fig. 2 used on "Index Mills," holes can be located and bored in an area of 8 by 16 inches. The indicators have 0.0001 inch graduations, with liberal spacings that aid in locating holes accurately. 69

Remote-Control Circuit-Breaker

The Spencer Thermostat Co., Attleboro, Mass., has placed on the market three remote-control circuit-breakers, known as "Klixon" D-7229, D-7230, and D-7231. These circuit-breakers are designed for the operation and control of any remote electrical load, and are especially adapted for aircraft and mobile applications. The breaker relays indicate circuit operation, and can be reset from a control panel.

The circuit-breaker is calibrated to precision tolerances, and will carry at least 115 per cent of its rated current capacity continuously. It will ultimately trip at 125 per cent of the rated current when operating in a room having a temperature of 77 degrees F. The actuating element in the circuit-breaker is the snap-acting "Spencer Disc" which provides a positive

Remote-control Circuit-breaker

make and break action. This disk is unaffected by vibration or shock.

These circuit-breakers can be had for trip-free or non-trip-free operation. They are furnished in three frame sizes with current ratings of from 35 to 200 amperes for circuits up to and including 30 volts direct current or 220 volts alternating current. 70

Chamfering and Burr-Removing Tools with Chrome-Plated Pilots

The Nobur Mfg. Co., 910 N. Orange Drive, Los Angeles, Calif., is now making the Nobur burr-removing and chamfering tools, previously described in MACHINERY, with the pilot shafts hard chromium-plated. This hard chromium treatment increases the life of the shaft and presents a surface that is resistant to the wear of various abrasives and hard materials on which these tools are used throughout the aircraft industry. 71

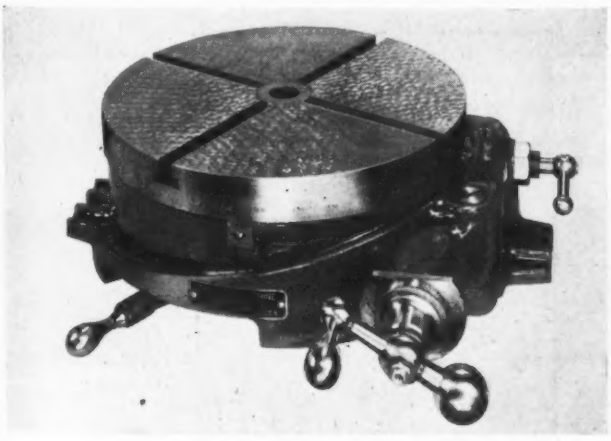


Fig. 1. Rotary Work-positioning Table Developed for Use on "Index Mills"

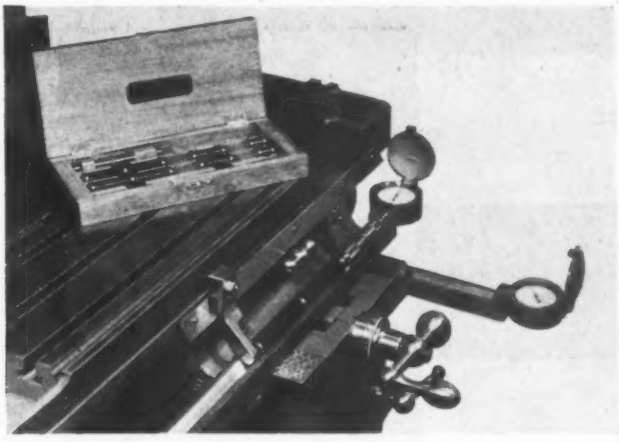


Fig. 2. "Index Mill" Equipped with Measuring Rods, Indicators, and Micrometer Heads

To obtain additional information on equipment described on this page, see lower part of page 178.

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LET'S WIN THE WAR!

3

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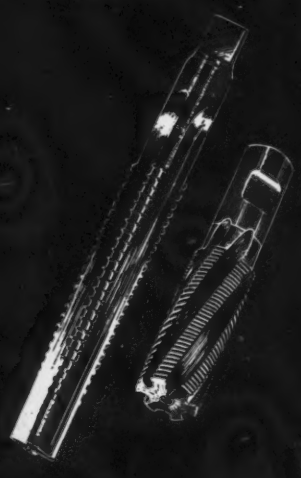
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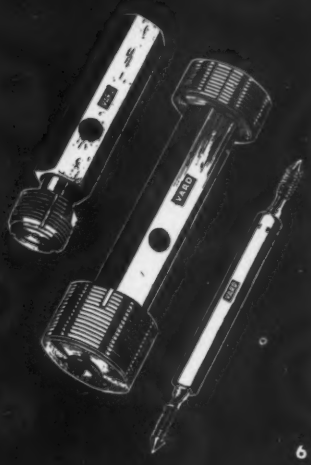
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RIN '44

VARD PRODUCTS CAN HELP YOU DO YOUR PART

VARD makes munitions of war—gages of all types, aircraft hydraulics and geared parts, optical elements and lens treatments.
In one of the most completely equipped precision manufacturing plants in the West we are turning out tools and parts that help carry on the war.
Let us help you complete your war contracts—on time. Let's work together to Win the War, and plan together for the Peace to follow.

VARD PRODUCTS

1. PRECISION AIRCRAFT HYDRAULICS
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4. LENSES, FILTERS, PRISMS, MIRRORS
5. SPECIAL TAPS
6. PLUG GAGES
7. RING GAGES
8. SNAP GAGES

8

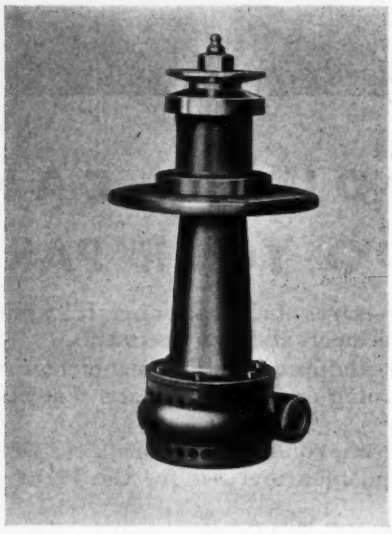
VARD INC.

PASADENA 8 , CALIFORNIA, U.S.A.

Gusher Pump Equipped for V-Belt Drive

The Ruthman Machinery Co., 1818 Reading Road, Cincinnati 2, Ohio, is placing on the market a new belt-driven gusher pump known as the Model 1-P3, which is designed to operate in a vertical position with a No. A V-belt drive from a detached motor or driving shaft. The one-piece shaft revolves on two ball bearings mounted within the tubular section between the plate flange and the V-pulley.

The pump stem, flange, and impeller housing are available in two lengths, and are interchangeable



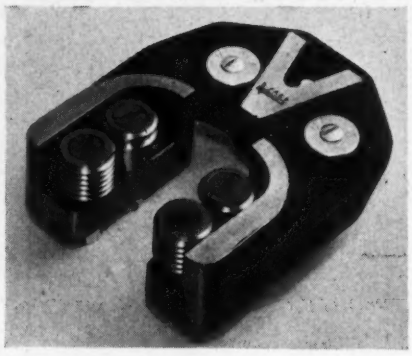
Ruthman Gusher Pump Equipped for V-belt Drive

with the same parts in the motor-driven pump of this model previously brought out. 72

Vard Roll Thread Snap Gage

Vard, Inc., 2961 E. Colorado Blvd., Pasadena 8, Calif., is now manufacturing thread snap gages with John-Sons rolls. This particular type of roll thread snap gage will check both right- and left-hand threads. The Vard snap-gage frame used to hold the Johns-Sons rolls has a grip molded to hand contours, as well as wide machine pads for bench stand set-ups, and is provided with a durable "wrinkle finish," to insure long life.

This snap gage is a combined "Go" and "No Go" inspection instrument for rapidly checking male

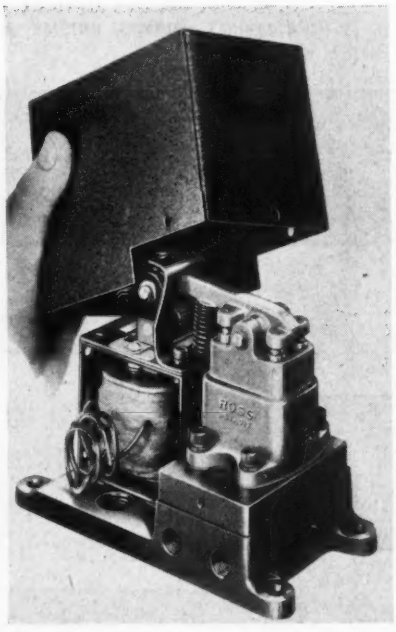


Roll Thread Snap Gage with John-Sons Rolls

threads to both maximum and minimum limits in one operation. It checks pitch diameter, thread angle, and lead. This gage is made in sizes for threads ranging from the numbered series up to and including threads 12 inches in diameter, and can be obtained in National, metric, Acme, Whitworth, and various other types of special thread forms. 73

Ross Midget Solenoid Air-Control Valve

An unusually compact solenoid-operated air-control valve, known as the Ross Model No. 835, which can be operated at sustained speeds up to as high as 400 reversals per minute is a recent development of the Ross Operating Valve Co., 6494



Ross Solenoid-operated Air-control Valve

Epworth Blvd., Detroit 10, Mich. This 1/4-inch, heavy-duty, four-way valve, designed for the control of double-acting cylinders, can also be used as a three-way valve by plugging up one outlet. It is 7 inches long, 3 1/2 inches wide, and 5 1/4 inches high. Among the features claimed for this pump are low current consumption, noiseless operation, and long life. 74

Kennametal File

Kennametal Inc., 147 Lloyd Ave., Latrobe, Pa., has developed a new type of file made of the same ce-

Kennametal File Adapted for High-speed Lathe Work

mented-carbide composition as the steel-cutting Kennametal tools for turning and boring operations. This file is especially adapted for use on work handled on lathes that have the higher spindle speeds necessary for efficient use of carbide-tipped cutting tools. Thus, the work can be filed without reducing or changing the high speeds used for the cemented-carbide tools.

Extended service trials have shown that the new files have an exceptionally long life. They will cut steels of any hardness up to 62 Rockwell C, and will also do good work on cast-iron and brass parts at surface speeds around 900 feet per minute. High-carbon, high-chromium steels have been successfully filed at 800 surface feet per minute with the new files, which were still in good condition after three weeks of use. 75

To obtain additional information on equipment described on this page, see lower part of page 178.

Only PHILLIPS Recessed Head Screws RATED OUR OKAY

...say 23 Leading Screw Manufacturers

FOR YEARS, leading screw makers tested ideas for recessed heads. All showed design faults. Then came the Phillips Recess. Unanimously, these makers agreed that here, at last, was the answer they'd been looking for . . . a scientifically engineered recess, *right* in every respect.

And practically the entire screw industry adopted it!

There's nothing exactly like the Phillips Recess. It's the only screw recess in which every angle, every dimension has a purpose—plays a definite part in screw driving efficiency and fastening strength.

That's why it pays to specify screws with Phillips Recessed Heads. You can get them in any head style, type, or size.

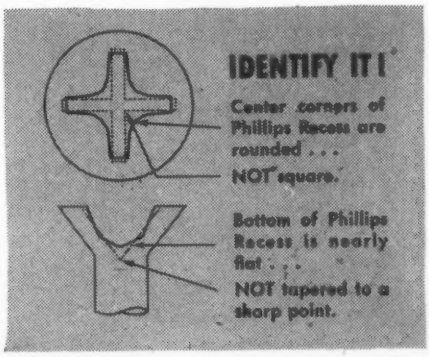
TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

FASTER STARTING: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

FASTER DRIVING: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

EASIER DRIVING: Turning power is fully utilized. Workers maintain speed without tiring.

BETTER FASTENING: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.


IDENTIFY IT!
Center corners of Phillips Recess are rounded . . .
NOT square.
Bottom of Phillips Recess is nearly flat . . .
NOT tapered to a sharp point.

AMERICAN SCREW CO.
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THE BRISTOL CO.
Waterbury, Connecticut
CENTRAL SCREW CO.
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CHANDLER PRODUCTS CORP.
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Chicago, Illinois
READING SCREW CO.
Norristown, Pennsylvania
RUSSELL BURDSALL & WARD BOLT & NUT CO.
Port Chester, New York
SCOVILL MANUFACTURING CO.
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SHAKEPROOF INC.
Chicago, Illinois
THE SOUTHINGTON HARDWARE MFG. CO.
Southington, Connecticut
WHITNEY SCREW CORP.
Nashua, New Hampshire

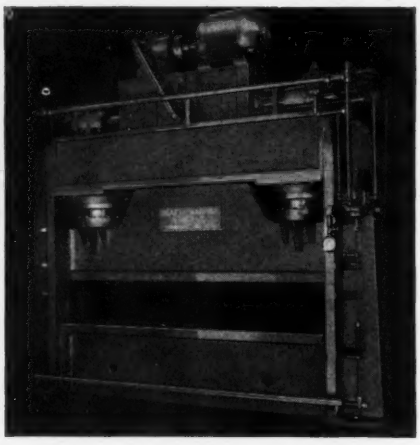
PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS
MACHINE SCREWS
SELF-TAPPING SCREWS
STOVE BOLTS

Beatty Hydraulic Straightening and Forming Press

The Beatty Machine & Mfg. Co., Hammond, Ind., is building a new line of hydraulic straightening and forming presses of the closed housing type, which are suited for straightening armor plate, general use in railroad car shops, and for other metal-working plants engaged in forming press parts, V-bending, and straightening long lengths of shafting and rolled shapes.

These new presses are built in sizes ranging from 100 to 600 tons

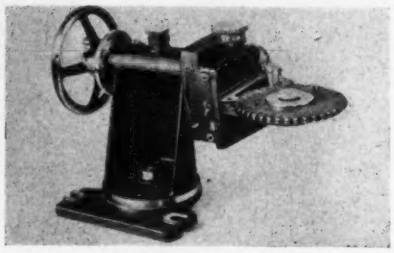


Beatty Heavy-duty Straightening and Forming Press

capacity. The maximum capacity of the press illustrated is 400 tons, and the stroke 8 inches. The advance speed of this press is at the rate of 330 inches per minute, the pressing speed 20 inches per minute, and the return speed 385 inches per minute. The operating pressure is 2000 pounds per square inch. The machine has a clear opening between the housings of 123 inches, a front-to-back dimension of 24 inches, and a maximum daylight opening of 18 inches. The minimum available die space is 10 inches. 76

Hill-Bartelt Radius-Grinding Fixture

The Hill-Bartelt Machine Co., 229 S. Church St., Rockford, Ill., has developed a new radius-grinding fixture for use on standard tool-grinding machines for profile-grinding 180-degree radius or smaller arc forms on the teeth of



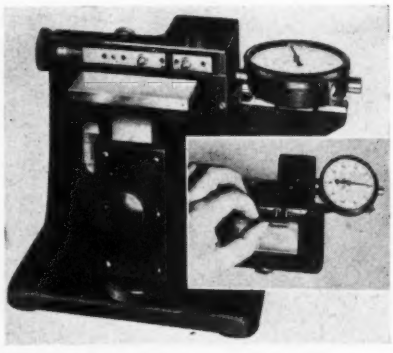
Radius-grinding Fixture for Tool-grinding Machines

milling cutters from 3 to 6 inches in diameter and up to 1 inch in thickness. This precision-built fixture has easily operated adjustments for quickly and accurately positioning the cutter for the desired radius and backing-off angle. The pedestal type base has two slots for bolting it to the grinder table.

While this fixture is designed primarily for radius grinding, it can be used for several other operations. With the cutter in a fixed position, side-cutting teeth can be ground. Tooth faces can also be ground radially or with any desired hook or rake. A 90-degree round corner of any radius up to 1/2 inch may be ground on cutter teeth. Other conventional grinding operations can be performed either before or after the radius grinding and without removing the cutter from the fixture. 77

Federal Thread-Lead Inspection Gage

The Federal Products Corporation, 1144 Eddy St., Providence 1, R. I., has recently added to its line a Model 1141 thread-lead inspection gage that is adjustable both for thread lead and diameter. The sensitive contact point of this gage



Thread-lead Inspection Gage Made by Federal Products Corporation

is free to float laterally with the axis of the thread so that it will locate itself positively between the sides of the thread. This contact point is so mounted that it transfers it motion to the dial indicator through a very sensitive mechanism, thus insuring the accuracy of the inspection operation. The gage is set by means of a master.

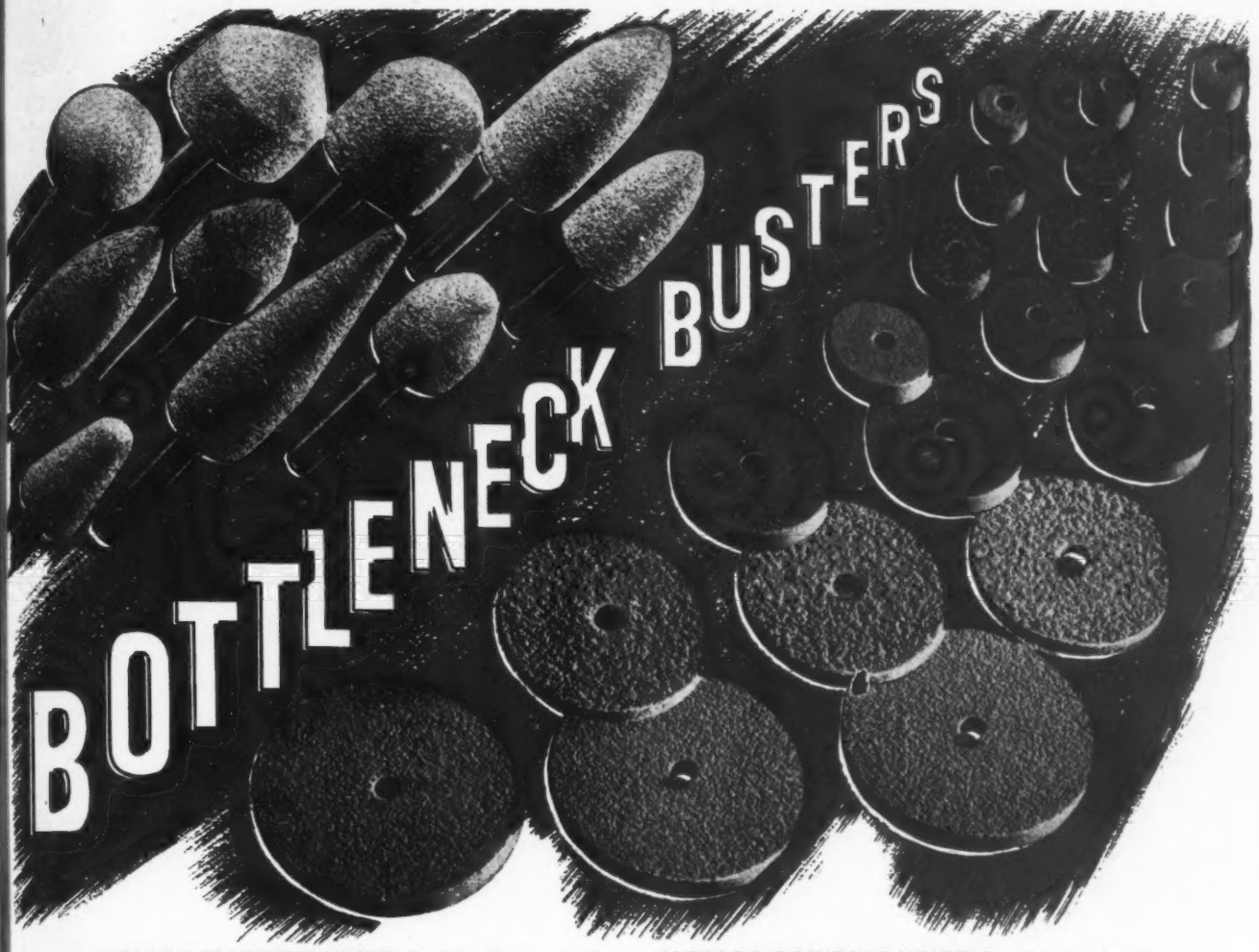
The dial indicator is graduated to read in increments of 0.0001 inch. Threads up to 1 1/2 inches in diameter can be inspected at a maximum distance between gaging points of 2 11/16 inches and a minimum distance of 3/16 inch. A special attachment makes it possible to check threads at a minimum distance of 0.156 inch between points. This lead-checking gage can be used to advantage with the Federal 45B type of thread pitch diameter gages previously described in MACHINERY. 78

"All-Weather" Welding Machine Made by the Wilson Welder and Metals Co., Inc.

Wilson "All-Weather" Type Welding Machine

The "Bumblebee" alternating-current welders, manufactured by Wilson Welder and Metals Co., Inc., 60 E. 42nd St., New York City, are now available in "All-Weather" models of 300 and 500 ampere capacities. These machines are similar to the standard Wilson Bumblebee welders, except that they have special moisture-proof insulation throughout, and all parts are protected by a heavy coating of moisture-proof paint. The outer case is finished in a durable weather re-

To obtain additional information on equipment described on this page, see lower part of page 178.



CHICAGO MOUNTED WHEELS—The first small wheels ever mounted on stationary shanks, they have maintained their supremacy through the years. Over 300 sizes, styles and grains—one to suit every job. They're tough, long lived, dependable.

CHICAGO GRINDING WHEELS—To break production bottlenecks due to the crying need for small wheels, we gave up making all larger sizes for the duration—with full WPB approval—and now specialize on sizes 3″ in diameter and under.

America's Unbeatables

Yes, all the wheels in our line are small, but powerful and *swift tools of war* doing their stuff day in and day out — making it possible to speed through everything that requires precision internal or external grinding, polishing and burring — bombsights, planes, tanks, guns, intricate instruments, etc.

PROMPT DELIVERY—Come to America's Headquarters for Small Wheels, custom built to your order. No waiting for shipments now, and after the war a reliable source of supply. Our central location is another asset—cuts shipping time to most plants.

Send the Coupon for Illustrated Catalog

CHICAGO WHEEL & MFG. CO.

1101 W. Monroe St., Dept. MR Chicago 7, Ill.

TEST WHEEL FREE—

So that you will know what Chicago Wheels can do, we'll gladly send one without charge. Tell us material you want to grind and size wheel you'd like.

• *Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry.*

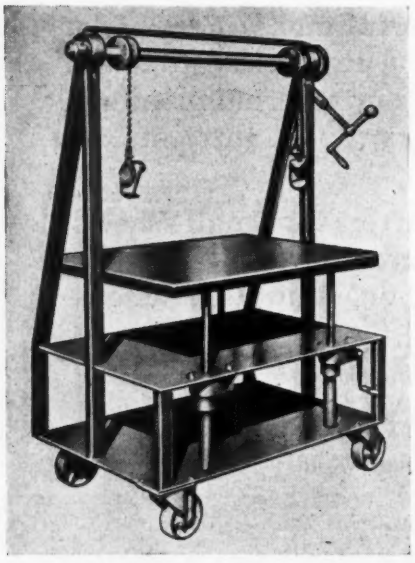
sisting enamel, and has gaskets and louvers designed to prevent entrance of rain.

These new "All-Weather" welders are equipped with a low-voltage contactor which automatically holds the open circuit voltage at approximately 40 volts. When the operator strikes the arc, the low-voltage contactor closes instantly, and the performance of the transformer thereafter is the same as that of machines not so equipped. 79

"Multiduty" Die Table

A new type rolling table, designed to serve as a portable workbench, a die set separator, and a lifting table for storing, moving, and setting up dies, as well as for supporting bars and sheets of steel for milling, and for countless other jobs performed by lifting tables, has been brought out by the Barrett-Cravens Co., 3250 W. 30th St., Chicago, Ill. Various features have been incorporated in this table to make the handling and separating of heavy dies a safe and easy one-man job. A small crank-operated overhead hoist enables the user to handle any piece quickly without jolts or jars. The table is simple to operate, runs smoothly on casters, and is sturdily built.

The die table is available in two models: Style B-1 will handle dies up to 40 inches long, and has a table capacity of 3000 pounds. The table height can be set between 24 and 40 inches. Style B-2 is designed to take dies up to 32 inches long, and will sustain a table load of 2000 pounds. The table height can be adjusted from 24 to 40 inches. Both models can be equipped with wheel brakes. 80



"Multiduty" Die Table Brought out by Barrett-Cravens Co.

Fearless Cutting Compound

A cutting oil compound for use in cutting high-speed, chrome-molybdenum, and National Emergency alloy steels, is being placed on the market by the Fearless Oil Co., 325 W. 11th St., Los Angeles 15, Calif. This cutting oil was developed in the shops of the Fearless Tool Co. for tapping chrome-molybdenum steel nuts and other parts. It is particularly recommended for tapping operations where it has proved difficult to obtain clean threads or where high cutting speeds are desirable. The new cutting oil has been used successfully in machining high-speed steels and heat-treated alloy steels and in threading Dural parts.

This cutting oil is a mixture of animal oils and other ingredients, and is claimed by the manufacturer to greatly prolong tool life before regrinding is necessary and to increase production to a marked degree by permitting the use of higher cutting speeds and by reducing heating of the tools and work. It is said to produce a very fine finish. 81

* * *

Wasteful Government Use of Telephone and Telegraph

According to Harry F. Byrd, United States Senator from Virginia, there is a current saying in Washington government offices: "Never write if you can send a telegram; never telegraph if you can make a long-distance call." For the six months ending December 31, 1942, the communications bill of the executive branch of the government—chiefly for telephone, telegraph, and cable—amounted to over $15,500,000. These figures do not include army and navy expenses for such communications. How much of this extensive communicating could have been conducted by letter or even by postcard no one knows. But we know that the general public is restricted in the use of the telegraph and telephone.

Annual Meeting of the Plastics Manufacturers' Association

At the recent annual meeting of the Plastics Materials Manufacturers' Association, which has headquarters in the Tower Bldg., 14th and K Sts., Washington, D. C., James L. Rodgers of the Plaskon Co., was re-elected president, and William Thiele of the Catalin Corporation, vice-president; John E. Walker continues as secretary-treasurer; and F. H. Carman has been appointed general manager. It is planned to broaden the activities of the association during the coming year, especially along technical lines. Through its Technical Committee, the association has compiled a data book pertaining to plastics, which was published in the latter part of 1943.

The expanded technical activities of the association planned for 1944 include the publication of data giving useful information obtained both from Government sources and from members, continued cooperation with the American Society for Testing Materials and other organizations interested in the properties of plastic materials, and the expansion and improvement of the data book along whatever lines will make it more valuable to the users of plastic materials.

* * *

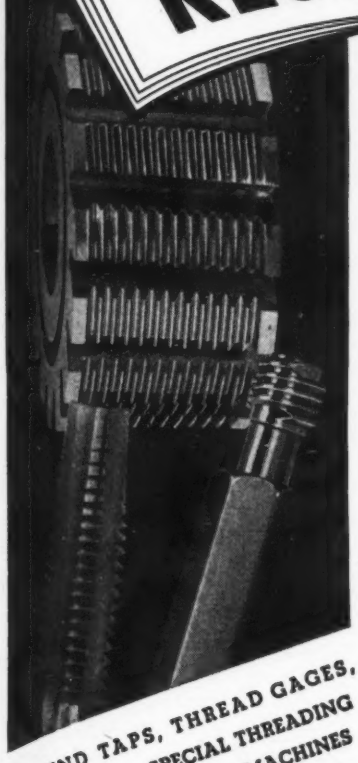
One Law for Union Officials and One for Employers

In the contracts that the War Labor Board has recently been ordering unions and employers to sign there is included one clause that deserves special attention because it is one of the few evidences of a two-sided approach to labor relations. In this clause the union agrees that "neither it nor any of its officers or members will intimidate or coerce employes into membership in the union." This is a sound provision. But it is doubtful whether there is any effective way in which the WLB can enforce it. Federal law, which contains plenty of penalties against intimidation or coercion on the part of employers, still contains no penalties whatever against intimidation or coercion on the part of union officers or members.—*New York Times*

To obtain additional information on equipment described on this page, see lower part of page 176.

WAR-TIME SHOP RECIPES

No. 9 in a Series



GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS. SPECIAL TAPPING MACHINES

DETROIT

Announces

IMPROVED LIGHT DUTY TAPPING MACHINES

with even greater accuracy

Ask for Bulletin No. LTM-44

BUY U.S. BONDS STAMPS

DETROIT TAP & TOOL CO.

8432 BUTLER
DETROIT 11
MICH., U. S. A.

Welding Brake-Rods in a Car Shop

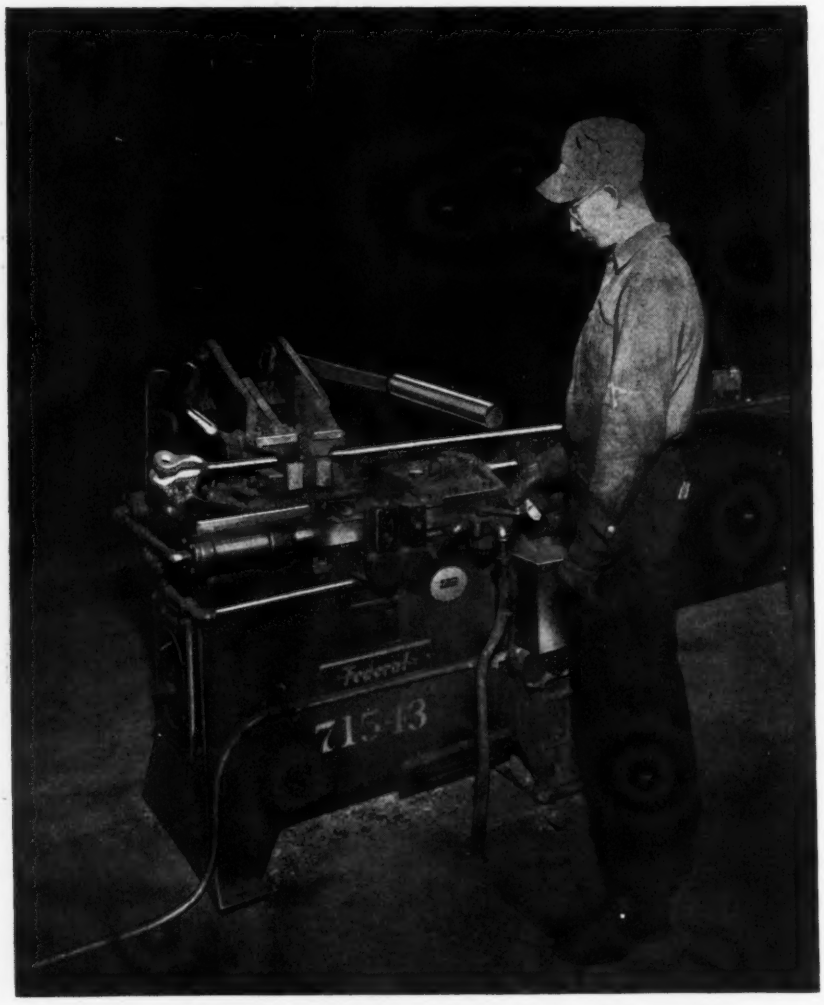
In the production of brake-rods, loop type brake-hangers, long tie-rods, etc., for freight and coal cars built at the Huntington, W. Va., Works of the American Car & Foundry Co. use is made of the Federal butt-welding machine here illustrated. This machine has a rating of 100 kilovolt amperes. The particular operation illustrated consists of welding a yoke forging to a plain round rod to produce a brake-rod. Bar stock of 1/2 to 1 inch in diameter is welded on this machine.

In the operation illustrated, the yoke forging is gripped between the top and bottom electrode jaws at the left, which remain in a fixed position during welding. The front end of the rod, which is to serve as a shank, is gripped between the jaws of a slide that moves toward the left under the action of a cam when the welding current is turned on to upset the weld. Hydraulic power is applied by moving a valve handle to effect quick withdrawal of the slide at the end of an operation. Both upper electrode jaws are mounted on hinged arms which are lifted by means of long handles for reloading the machine.

* * *

Gear Production Still Increasing

The American Gear Manufacturers Association has announced that there was an increase of 5 per cent in the business booked in November, 1943—the last month for which complete statistics are available—as compared with October. These figures do not include turbine or ship propulsion gearing.



Butt-welding Machine which is Employed in a Car Shop for Welding Various Types of Forgings to Round Rods

Army-Navy "E" Awards

The following companies in the machine-building and allied industries have received renewals of the Army-Navy "E" Award for continued high production in furtherance of the war effort:

H. M. Harper Co., Chicago, Ill. (third award)

Heppenstall Co., Pittsburgh, Pa. (fifth award)

Star Electric Motor Co., Bloomfield, N. J. (second award)

De Vilbiss Co., Toledo, Ohio (second award)

* * *

X-Ray Pictures of Bullets in Gun Barrels

X-ray pictures or radiographs taken in a millionth of a second with a 300,000-volt X-ray machine make it possible to study the action of bullets in motion within gun barrels, as well as the action when they hit targets of different types of resisting materials. The Westinghouse equipment that makes this possible weighs 1500 pounds, is 8 feet long, 7 feet high, and 3 feet wide.

Projecting from the front of the carriage, which is mounted on wheels, is an ultra high-speed tube, 24 inches long. The first experimental tube which made this equipment possible was developed by the Westinghouse Lamp Laboratories, Bloomfield, N. J., by Dr. Charles M. Slack and his associates.

* * *

A Folding Ladder for Shop Use

As unusual type of ladder has been developed for industrial use by the Duo-Safety Ladder Corporation, Oshkosh, Wis. This ladder is so constructed that the sides and rungs can be folded together in such a manner as to make a bundle only 3 inches wide by 3 inches deep, the length, of course, being the length of the ladder. This feature makes the ladder easier to handle, especially since the construction is such as to make it light in weight. A locking device keeps the ladder rigid in the open position. The ladder is equipped with Duo-Safety shoes, which insure safety while working on all types of surfaces.

REEVES

1 Any speed—not just step speeds—between predetermined limits, on any driven machine.

2 Any desired speed setting maintained without slippage or fluctuation over entire speed range.

3 Speed changes made easily and quickly without stopping the machine.

Speed control is a *relative* term. Even the old step-cone and belt-changing method had it to a degree. Gear changers, too, go part of the way. But to have *all* of the advantages of speed adjustability, the variation must be *infinite and accurate*, even to a fraction of a revolution.

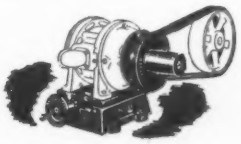
Then, and only then, is it possible to obtain exactly the right speed for each job, for each kind of material, for each process. Having this stepless, infinitely variable speed adjustability at the machine operator's command speeds up production, prevents spoilage, and reduces costs.

Because REEVES Speed Control has all of these outstanding features of superiority plus dependability, born of specialization in speed control design and manufacture, more REEVES units are in use today than all other makes put together. Let us help you apply accurate speed control to your machines. We maintain a nation-wide staff of seasoned speed control engineers to serve you!

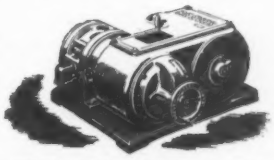
Table to which work is clamped is rotated at exactly the proper rate for fast, uniform downhand welding because driven through a REEVES *Variable Speed Transmission. This 14,000-lb. capacity welding positioner, manufactured by Cullen-Friestedt, is handling a gear blank for large reduction gears used on steam turbine and Diesel-driven ships.*

THE *Three* BASIC UNITS IN *REEVES* LINE

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range—2:1 to 16:1 inclusive. Sizes fractional to 87 h.p. Vertical and horizontal designs.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. Ratios of speed variation within 3:1. Sizes to 15 h.p.



VARI-SPEED MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 h.p.

REEVES *Accurate Variable* Speed Control

★ **REEVES PULLEY COMPANY • COLUMBUS, INDIANA**

Send copy of new catalog-manual M-435, describing REEVES Speed Control units and their application to all types of production machines.

NAME_____ COMPANY_____

TITLE_____ ADDRESS_____

News of the Industry

California

F. N. KEITHLEY has been appointed district engineer of the Thermit Department of the Metal & Thermit Corporation, 120 Broadway, New York 5, N. Y. His headquarters will be at the corporation's South San Francisco branch. Mr. Keithley has been associated with the Metal & Thermit organization since 1908.

ROBERT H. CLARK CO. has completed a new plant at 9330 Santa Monica Blvd., Beverly Hills, Calif. The new plant will provide facilities for greatly increasing the production of adjustable cutting tools and automatic tapping machine conversion units. It houses manufacturing and service departments, tool development and research laboratories, and executive and administrative offices.

Illinois

L & R MFG. CO., 577 Elm St., Arlington, N. J., announces the opening of a Chicago sales office in the Pittsfield Bldg., Suite 834, 55 E. Washington St. JOHN W. DENNISTON will be in charge of the new office in the capacity of western sales manager. He will cover the states of Minnesota, Iowa, Missouri, Kentucky, Wisconsin, Illinois, Michigan, West Virginia, Indiana, Ohio, western Pennsylvania, and Tennessee. He was formerly in charge of sales in the New England area.

PHILIP S. HILL has been promoted to the position of assistant manager of the Eastern Division of the Willamette Hyster Co., Peoria, Ill. For the last two years he has been manager of the Washington, D. C., office of the company. FRANK MCMILLAN will assume the position of manager of the Washington office, vacated by Mr. Hill. He was previously in charge of the sales and service department of the company.

E. L. BERRY, vice-president and general manager of the Link-Belt Ordnance Co., has been elected vice-president of the parent organization—the Link-Belt Co. His headquarters will be at the general office, 307 N. Michigan Ave., Chicago, Ill. RICHARD F. BERGMANN, chief engineer has also been elected a vice-president of the company. JOHN E. MARTIN has been appointed manager of the Link-Belt Ordnance Co.

V. N. CRASNOFF has been named assistant general superintendent of the Western Cartridge Co., East Alton, Ill. Mr. Crasnoff has been connected with the company since 1920, and has contributed to many of the modern improvements in ammunition manufacture. He was previously associated with the Research Department and with the Production Division of the company. R. W. MERKLE will succeed Mr. Crasnoff as superintendent of the Ammunition Division.

S. O. BJORNBERG, consulting engineer of the Illinois Tool Works, Chicago, Ill., has been appointed a member of the Sectional Committee on Small Tools and Machine Tool Elements of the American Standards Association, 29 W. 39th St., New York City. The work of this committee is carried on by twenty technical sub-committees.

Michigan

CARBOLOY COMPANY, INC., Detroit, Mich., again announces a reduction in the price of cemented-carbide tools, resulting from additional manufacturing economies in the mass production of standard single-point tools. With the latest reductions, the prices of Carboloy cemented-carbide standard cutting tools are said to be generally comparable with those of virtually any cutting tool material. The reductions affect grades both for steel cutting and for machining non-ferrous metals, cast iron, and non-metallics. Addition of grade 78-C to the standard tool line for sizes of 3/4 inch or more is announced at the same time.

GENERAL MOTORS CORPORATION announces that the Grand Rapids plant, now operated by the Saginaw Steering Gear Division of General Motors, has become an independent division of General Motors known as the Diesel Equipment Division. It will manufacture injectors for all General Motors Diesel engines. C. F. RUNCHEY, who was manager of the Grand Rapids plant, has become general manager of the new division, and C. W. TRUXELL, of the engineering staff of the Detroit Diesel Engine Division, has become chief engineer of the Diesel Equipment Division.

SUPER TOOL CO., Detroit, Mich., announces a 25 per cent price reduction on standard Carboloy-tipped milling cutters. Continual engineering research and development, improved manufacturing techniques, and increased production facilities all have contributed to make these new low prices possible.

VERNOR ENGINEERING CO., 2280 Fourteenth St., Detroit 16, Mich., a tool and production engineering concern, has changed the firm's name to CHARLES W. DOWNS & SON CO. There is no change in the company's ownership, management, or operation.

MICHIGAN TOOL CO., Detroit, Mich., has established branch offices at 1217 Grant Bldg., Pittsburgh 19, Pa., with A. OLSON as district manager; and at 1109 Fletcher Trust Bldg., Indianapolis 9, Ind., with JOE R. ARMSTRONG in charge.

New England

RICHARD W. BANFIELD has been elected secretary of the Niles-Bement-Pond Co., West Hartford, Conn. Mr. Banfield became connected with the Pratt & Whitney Division of the organization in 1935. He became assistant secretary in 1936, and added the duties of office manager in 1939, when the company moved into its new West Hartford plant. He will retain the position of office manager. Mr. Banfield was born in Newton, Mass., and is a graduate of Dartmouth.

Richard W. Banfield, Newly Elected Secretary of the Niles-Bement-Pond Co.

BENJAMIN H. GILPIN, MILTON E. CHANDLER, and JOHN B. BYRNE have been elected directors of the Niles-

LANDING OPERATIONS AT KISKA. *Official U. S. Navy Photo*

Whenever our fighting men make a landing, they have the best equipment American Industry can produce. A large part of this equipment is fabricated on Lake Erie Hydraulic Presses.

. . . . Put it up to Lake Erie

Bement-Pond Co., West Hartford, Conn. Messrs. Gilpin and Chandler are both connected with the Chandler-Evans Corporation, South Meriden, Conn., which was recently merged with the Niles-Bement-Pond Co. Mr. Gilpin is vice-president, general manager, and treasurer of the Chandler-Evans Corporation, and Mr. Chandler vice-president in charge of engineering. Mr. Byrne has been president of the Hartford-Connecticut Trust Co. since 1932.

JAMES P. BALDWIN has been appointed general manager of the Corbin Screw Corporation, Division of the American Hardware Corporation, New Britain, Conn., manufacturer of precision hardened and ground aircraft

James P. Baldwin, New General Manager, Corbin Screw Corporation

parts and screws. Mr. Baldwin has been connected with the company since 1920 in various capacities, most recently as works manager.

BRUCE PRICE, formerly with the Landis Tool Co., Waynesboro, Pa., has become associated with Stedfast & Roulston, Inc., 156 Oliver St., Boston, Mass., machine tool distributors. Mr. Price will handle the sale of machine tools in the state of Rhode Island, eastern Connecticut and southeastern Massachusetts.

ALFRED A. LAWRENCE, who has been connected with the Dow Chemical Co., Midland, Mich., since 1940 has been appointed manager of the New England sales office at 20 Providence St., Boston, Mass.

BAY STATE ABRASIVE PRODUCTS Co., Westboro, Mass., has recently adopted the trade name "Blue-Flash" to identify the Bay State line of abrasive products.

New Jersey

IRRGANG ENGINEERING Co., 744 Broad St., Newark, N. J., has recently been organized by L. Irrgang to engage in consulting engineering practice with the purpose of assisting manufacturers in reducing operation costs, designing tools, and laying out metal stampings. Mr. Irrgang was previously associated with the Lott Universal Bearing Co. as chief engineer, and more recently served as manufacturing engineer with the Western Electric Co. He is a member of the American Society of Tool Engineers and the American Society of Mechanical Engineers.

K. E. SUTTON, who has been associated with the Wright Aeronautical Corporation since 1929 as assistant factory manager, production manager, and general superintendent of its plants in the Paterson, N. J., area, has been named manager of the Wood-Ridge, N. J., warplane engine plant of the company. A. M. SCHEERER, experimental engineer with the organization for the last eight years, has been appointed engineering manager of the same factory, succeeding A. AMUNDSEN, who has been granted a leave of absence because of illness.

V. C. MEKEEL has resigned as superintendent of foundries of Ampco Metal, Inc., Milwaukee, Wis., to accept the management of product engineering and sales development for the Syncro Machine Co., of Rahway, N. J. Mr. Mekeel has been active in the metal industry for the last twenty-five years in plant operation, engineering, metallurgical, and sales capacities.

TITEFLEX METAL HOSE Co., 500 Frelinghuysen Ave., Newark, N. J., announces that the concern will hereafter be known as TITEFLEX, INC. The change in name has been made because the former name is no longer descriptive of all the products manufactured by the company.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., has taken over the RANSOME MACHINERY Co., manufacturer of welding positioning equipment. Ransome welding positioners are now available through Worthington district offices in all the principal cities.

New York

W. S. ROCKWELL Co., 50 Church St., New York 7, N. Y., has purchased the business of the GEHNRICH CORPORATION, Long Island City, N. Y., for over sixty years engaged in the development and building of industrial ovens, driers, and air heaters. The concern will be operated as the Gehnrich Oven Division of the W. S. Rockwell Co. The engineering, manufacturing, and sales personnel of the old firm will be retained.

DACO, INC., 37-06 Thirty-sixth St., Long Island City 1, N. Y., announces that the firm has been dissolved and is succeeded by the DACO MACHINE & TOOL Co., which is composed of the former corporation's controlling interests and associates.

ALLEN N. CANDEE, mechanical engineer of the Gleason Works, Rochester, N. Y., has been appointed a member of the Sectional Committee on the Standardization of Gears of the American Standards Association.

Ohio

CINCINNATI PLANER Co., Cincinnati, Ohio, has recently appointed the following sales representatives in the Northeast: HARRINGTON-WILSON-BROWN Co., Chrysler Bldg., New York City, for northern New Jersey, eastern New York and Connecticut; LYND-FARQUHAR Co., Park Square Bldg., Boston, for Massachusetts, Rhode Island, New Hampshire, Vermont, and Maine; C. H. BRIGGS MACHINE TOOL Co., INC., Onondaga Hotel, Syracuse, N. Y., for the Syracuse area; and GEORGE KELLER MACHINERY Co., 1807 Elmwood Ave., Buffalo, for western New York State. The Cincinnati Planer Co. was represented in all this area for over forty years by Henry Prentiss & Co., Inc., which recently retired from business.

H. I. LEWIS, of Hartford, Conn., has been made executive vice-president of the Weatherhead Co., Cleveland, Ohio, manufacturer of fittings for automotive, aviation, and a wide variety of

H. I. Lewis, Executive Vice-president of the Weatherhead Co.

MACHINERY'S DATA SHEETS 507 and 508

MOMENT OF INERTIA, ETC., FOR STANDARD-WEIGHT STRUCTURAL CHANNELS—5

Values of Moment of Inertia I, Section Modulus S, and Radius of Gyration r for Two Channels Placed Back to Back at Varying Distances Apart

Size, Inches	Weight of One Channel, Pounds	Area of Two Channels, Square Inches	Flange Width, Inches	Factor	Distance Apart B, Inches										
					7	8	9	10	11	12	13	14	15	16	17
					Values of I, S, and r										
8	11.5	6.72	2.26	I	114.00	143.00	175.30	211.00	250.10	292.40	.....	.....	.....	.....	.....
				S	19.80	22.80	26.00	29.10	32.30	35.40	.....	.....	.....	.....	.....
				r	4.13	4.62	5.12	5.60	6.10	6.62	.....	.....	.....	.....	.....
9	13.4	7.78	2.43	I	134.80	168.80	206.50	248.20	293.80	343.00	.....	.....	.....	.....	.....
				S	22.70	26.20	29.80	33.40	37.00	40.70	.....	.....	.....	.....	.....
				r	4.17	4.65	5.16	5.65	6.14	6.66	.....	.....	.....	.....	.....
10	15.3	8.94	2.6	I	157.40	196.60	240.20	288.20	340.70	397.70	459.20	525.10	595.50	670.40	.....
				S	25.80	29.80	33.85	38.00	42.20	46.00	50.50	54.70	59.00	63.30	.....
				r	4.20	4.68	5.19	5.68	6.17	6.69	7.16	7.66	8.17	8.68	.....
12	20.7	12.06	2.94	I	221.00	274.70	334.40	400.20	472.00	549.80	633.70	723.60	819.50	921.50	.....
				S	34.40	39.60	45.00	50.40	55.80	61.50	67.20	72.80	78.40	84.50	.....
				r	4.28	4.78	5.27	5.75	6.25	6.75	7.25	7.75	8.25	8.75	.....
15	33.9	19.8	3.4	I	381.50	471.50	571.40	681.20	800.80	930.40	1069.90	1219.20	1378.50	1547.70	.....
				S	55.30	63.80	72.50	81.10	90.80	99.10	108.00	116.50	126.20	135.80	.....
				r	4.38	4.88	5.37	5.87	6.37	6.87	7.37	7.87	8.37	8.87	.....
18	42.7	24.96	3.95	I	513.00	629.00	757.00	897.00	1055.00	1217.00	1397.00	1583.00	1797.00	1997.00	2234.00
				S	69.00	79.20	89.50	100.10	111.50	122.20	133.20	144.50	157.00	167.00	179.20
				r	4.54	5.02	5.52	5.98	6.50	6.97	7.46	7.97	8.50	8.95	9.45

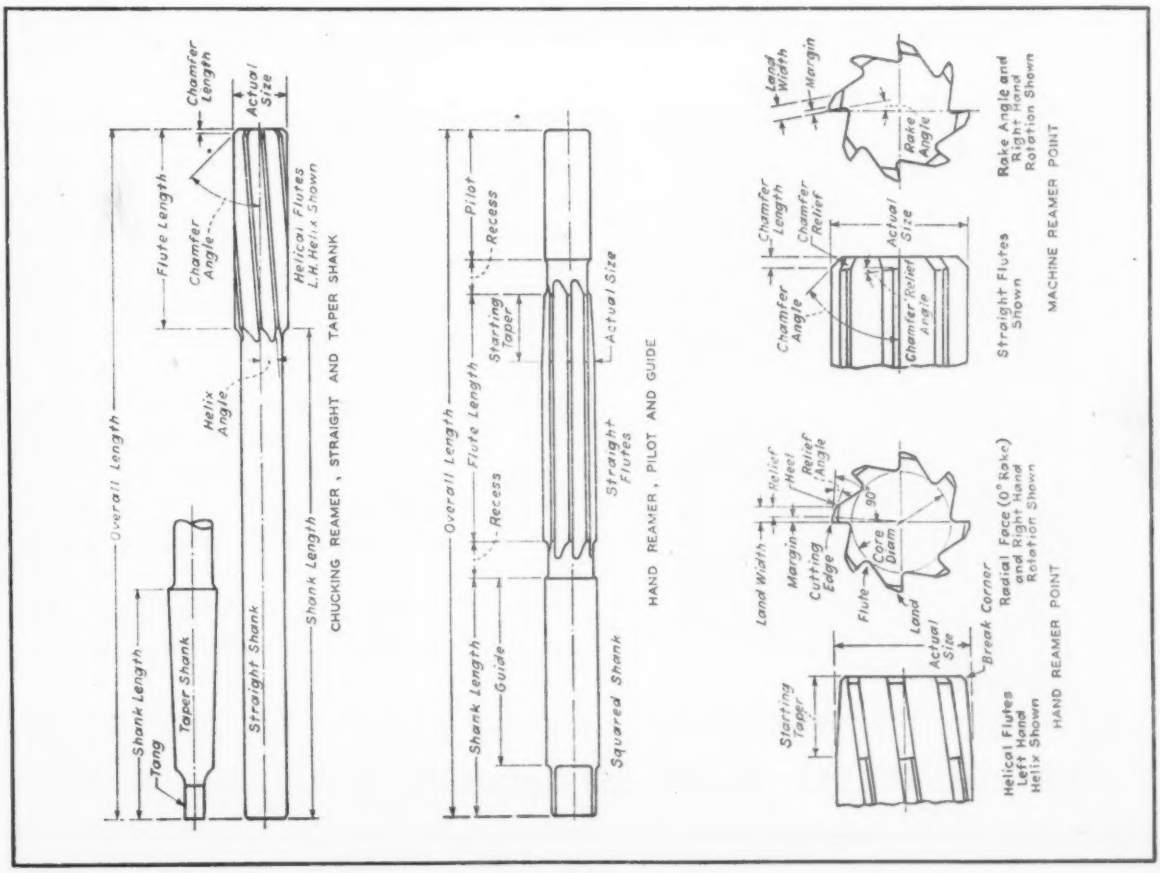
Note: The radius of gyration with respect to axis 1–1 is equal to that with respect to axis 2–2 when B is 4.94 inches for 8-inch size channels; 5.63 inches for 9-inch size channels; 6.33 inches for 10-inch size channels; 7.67 inches for 12-inch size channels; 9.50 inches for 15-inch size channels; 11.27 inches for 18-inch size channels.

MACHINERY'S Data Sheet No. 507, February, 1944

Compiled by J. Lewis Luckenbach

NOMENCLATURE FOR REAMER PARTS

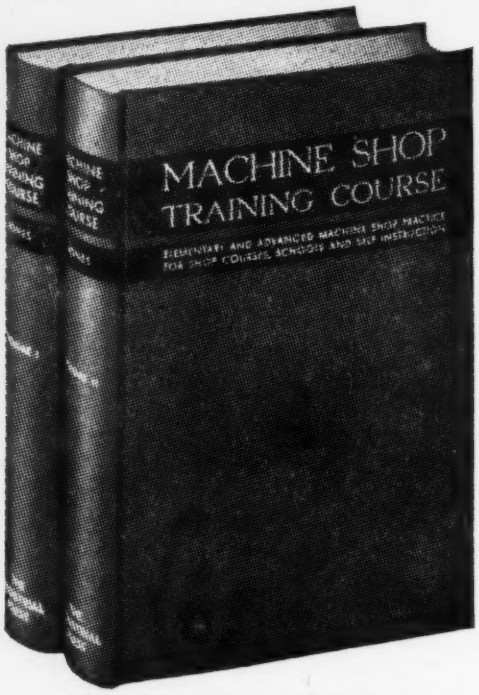
From "Industrial Standardization," Published by the American Standards Association



MACHINERY'S Data Sheet No. 508, February, 1944

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS



Price $6 Set—Payable $2 with Order, $2 Monthly

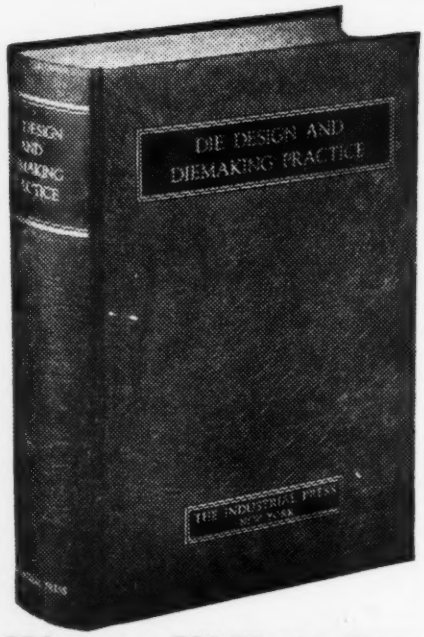
This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains about 1000 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Die Design and Diemaking Practice

THE MOST COMPLETE TREATISE IN EXISTENCE ON DIES



956 pages, 590 illustrations

If you design, make or use dies for blanking, forming or drawing sheet-metal parts, here is a veritable die designer's and diemaker's bible. This die book presents not only descriptions and drawings of a tremendous variety of dies, but a vast amount of data representing a lot of boiled down and costly die experience. Dies of the same general classes are grouped together in chapters. The drawing dies have been placed into chapters according to the general shapes of the parts produced, to facilitate finding the type of die for producing a given shape.

Price $6—payable if desired $2 with order and $2 monthly for two months.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

industrial equipment. HENRY F. BAILEY, of Cleveland, has been appointed vice-president in charge of finance.

WALTER G. HILDORF, formerly chief metallurgical engineer of the Timken Roller Bearing Co., Canton, Ohio, has been made director of metallurgy—a newly created office. Mr. Hildorf will be succeeded as chief metallurgical engineer by RALPH L. WILSON, formerly chief of the Constructional Steels Section of the Metallurgical and Conservation Branch, Steel Division, of the War Production Board in Washington, D. C. A. M. DONZE, factory manager of the company for the last eight years, has become vice-president in charge of production, and H. M. RICHEY, assistant factory manager, has been promoted to the position of factory manager.

PAUL REEVES has been appointed advertising manager of the Timken Roller Bearing Co., Canton 6, Ohio, succeeding ROLAND P. KELLEY, who has occupied that position for the last seventeen years and recently resigned to go into advertising agency work. Mr. Reeves became connected with the company in 1929, and in 1940, was made sales promotion manager. When this country entered the war, he was put in charge of Government priorities to handle contacts between the company and Washington.

WARNER & SWASEY CO., Cleveland, Ohio, has purchased the manufacturing rights to the Bakewell tapping machine from the Bakewell Mfg. Co., Los Angeles, Calif. The machine will be known in the future as the Warner & Swasey precision threading and tapping machine. It will be built in the company's Cleveland plants, and its sale will be handled by the branch offices that handle Warner & Swasey turret lathes.

WILLIAM O. LIPPMAN has been awarded the Westinghouse Order of Merit for his leadership in converting the Westinghouse plant in East Springfield, Mass., from peacetime to wartime production. Mr. Lippman was works manager of the East Springfield Works when that plant was changed over to war production. Later he was transferred to the company's Canton, Ohio, Ordnance Division as manager of that plant.

TIMKEN ROLLER BEARING CO., Canton 6, Ohio, manufacturer of graphitic and alloy steels, announces that the PENINSULAR STEEL CO., of Cleveland, Ohio, has been assigned the territory of Dayton and Cincinnati, formerly covered by Quality Steels, Inc., of Dayton, and Frederick Steel Co., of Cincinnati.

ROBERT W. WORLEY has recently been appointed chief engineer of the Union Drawn Steel Division of Republic Steel Corporation, Massillon, Ohio. Prior to his new appointment, Mr. Worley was with United Engineers & Constructors, Inc., of Philadelphia.

CLAUD S. GORDON CO., distributor of industrial X-ray equipment, furnaces, pyrometers, etc., announces that the office and factory of the company is now located at 7016 Euclid Ave., Cleveland, Ohio. The new quarters afford double the previous space.

E. B. FARRIS, formerly connected with the Edgar T. Ward's Sons Co., Cleveland, Ohio, was recently made a representative of the Steel Division of the Copperweld Steel Co., Warren, Ohio, with headquarters in the Cleveland office of the company.

JEFFERSON MACHINE TOOL CO., Fourth, Cutter, and Sweeney Sts., Cincinnati, Ohio, announces that it is ready to enter into negotiations with dealers and salesmen for some open territories for the coming year.

KELLY REAMER CO., Cleveland 1, Ohio, has appointed LOUIS MALCOLM EDGAR, 1500 Cadillac Square Bldg., Detroit 26, Mich., exclusive sales and engineering representative for the company in the state of Michigan.

Pennsylvania

CHARLES LUKENS HUSTON, pioneer steel master and first vice-president of the Lukens Steel Co., Coatesville, Pa., celebrated on December 30 the sixty-eighth anniversary of his entry into the employ of the company in 1875. Mr. Huston was born in Coatesville in 1856. In 1879, he became a partner in the firm; and from 1882 to July, 1925, he was in sole charge of operations of all plants. He still comes to the office every day and inspects the mills several times weekly.

JAMES N. MORRELL has recently been made sales manager of the Limitorque Valve Control Division of the Philadelphia Gear Works, Philadelphia, Pa. THOMAS V. WITHINGTON, formerly chief engineer, has become assistant sales manager of the Limitorque Division, and is succeeded as chief engineer by WILLIAM F. PLUME. ROBERT E. RICHARDS is assistant chief engineer.

LEON R. LUDWIG, formerly head of the Circuit-Breaker and Protective Devices Division of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been named manager of the Motor Division of the company, succeeding R. W. OWENS, who has resigned.

JAMES H. JEWELL has been appointed assistant manager of industry departments of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Jewell has been manager of the company's agency and specialties department since 1940, and will continue to head that division.

Washington, D. C.

PINKNEY W. LOVE has been appointed manager of the Washington, D. C., office of the Lukens Steel Co. and its subsidiaries, succeeding CHARLES A. CARLSON, who is resigning to establish his own business, manufacturing the Carlson internal combustion engine.

Wisconsin

GRAHAM TRANSMISSIONS, INC., Milwaukee 6, Wis., manufacturer of variable-speed drives, announces the appointment of the following representatives: FRANK CAMPBELL COE, Commercial Trust Bldg., 15th and Market Sts., Philadelphia 2, Pa.; JOHN B. FOLEY, JR., Co., 249 Erie Blvd. W., Syracuse, N. Y.; PAUL M. KLINE, 2030 E. 22nd St., Cleveland, Ohio; BRUCE W. ROGERS, P. O. Box 172, 850 S. High St., Akron, Ohio; and D. W. SMITH, 149 Broadway, New York 6, N. Y.

GEORGE E. WESTERHOLM has been appointed an abrasive engineer for the Milwaukee territory by the Norton Co., Worcester, Mass., where he will assist F. W. Grant. Mr. Westerholm, who has been with the Norton Co. twenty-one years, was formerly connected with the research laboratories, and more recently specialized as field engineer serving steel mills and foundries.

L. V. TUTTLE has been made foundry manager of the Gisholt Machine Co., Madison, Wis. He was formerly associated for twelve years in a similar capacity with the Koehring Co. of Milwaukee.

JAMES D. CUNNINGHAM was recently elected a member of the board of directors of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., succeeding CHARLES W. COX, who has resigned because of illness.

* * *

The American railroads in 1943 handled the greatest volume of freight and passenger traffic in their history. The freight traffic amounted to 725,000,000,000 ton-miles; this was an increase of 13.9 per cent above that for 1942, the previous record year. It was 1.75 times the volume moved in 1918, the peak year in the last war. The passenger traffic in 1943 reached the enormous figure of 85,000,000,000 passenger-miles; this is an increase of 58 per cent over the traffic in 1942, twice the traffic in 1918, and nearly four times the traffic in 1939.

Obituaries

Paul C. De Wolf

Paul Churchill De Wolf, vice-president of the Brown & Sharpe Mfg. Co., Providence, R. I., for the last nineteen years, died of pneumonia on December 19 at the age of sixty-one years. Mr. De Wolf was born in Bristol, Conn., on August 1, 1882. He was educated in the public schools of Newark and was graduated from the Newark High School. In 1901, he entered Brown University, and was graduated in 1905 with the degree of Ph.B.

After his graduation, he became associated with the Brown & Sharpe Mfg. Co. under special instruction, with the intention of joining his uncle's business—Charles Churchill & Co., London, machine tool merchants. During his training, however, he decided to remain with Brown & Sharpe, and after two years of apprenticeship, he was made assistant superintendent of the small tool department. Two years later, he was transferred to the sales office, where he directed the sales of the foundry and gear departments. In 1913, he entered the administrative branch of the firm, and the following year was made assistant treasurer. In 1924, he was elected vice-president.

Mr. De Wolf was known nationally in the machine tool industry. He was elected president of the National Metal Trades Association in 1924, and was a former secretary of the Machinery and Allied Products Institute. He was a member of the American Society of Mechanical Engineers and of the Providence Engineering Society. He was also a director of several banking and other institutions, and a trustee of Brown University.

He is survived by his wife and a son, Robert, a corporal in the Marine Corps.

Paul C. De Wolf

Henry E. Miller

Henry E. Miller, president of the Chicago Wheel & Mfg. Co., Chicago, Ill., died at his home in that city January 10 after a brief illness. Mr. Miller was born in 1863 on a farm in Illinois. He was first trained to become an expert machinist and later was employed as traveling salesman for the Minnesota Thresher Co. In 1894, he became manager of the Chicago Emery Wheel Co., which he later purchased, becoming its president and changing its name to the Chicago Wheel & Mfg. Co.

Henry E. Miller

Mr. Miller exercised his inventive ingenuity in this business, and introduced a number of important innovations in the abrasive industry. He was one of the first manufacturers to mount small wheels on steel shanks for use in various professions and trades—for example, in dental work, in instrument and precision tool manufacture, and in the jewelry trades. He also developed a number of important bonds widely used throughout the grinding wheel industry.

Mr. Miller was one of the founders of the Grinding Wheel Manufacturers Association, and in experience one of the oldest men in the industry. A son, Arthur J. Miller, who has been identified with his father in business for many years, survives him, and will continue to direct the company.

Frank P. Miller

Frank P. Miller, president and treasurer of McCrosky Tool Corporation, Meadville, Pa., died suddenly of a heart attack on December 11 at his home in Meadville. Mr. Miller had been actively associated with McCrosky Tool Corporation for thirty-six years. He began as a sales engineer in 1907, shortly after his graduation from Allegheny College. One year later he became general manager, and in 1922 he was elected president and treasurer of the company. In addition to being an able executive and industrialist, Mr. Miller was a successful inventor. From his many inventions resulted the metal-cutting tools and machine tool attachments manufactured by McCrosky Tool Corporation. He was a member of the American Society of Mechanical Engineers.

Throughout his life Mr. Miller was active in many civic and philanthropic enterprises. From 1922 to 1926 he served his local district in the Pennsylvania State Senate. At the time of his death, he was chairman of the Board of Trustees of Allegheny College and first vice-president of the State Y.M.C.A. of Pennsylvania. He took a prominent part in the affairs of the Methodist Episcopal Church.

Roland J. Houck

Roland J. Houck, director of the Motch & Merryweather Machinery Co., Cleveland, Ohio, and in charge of the company's manufacturing division, died in Tucson, Arizona, December 25, after a long illness. He was fifty-one years old. Mr. Houck was born in Cleveland on September 28, 1892. He joined the Motch & Merryweather organization in 1909, and was for many years manager of the company's used machinery department. During the

The Adirondack Foundries and Steel Corporation with contracts for gun forgings knew that these forgings tend to warp during heat treatment and therefore require means for straightening. For this purpose Baldwin designed this special 350-ton self-contained, oil-operated, high speed straightening press. This press not only possesses sensitive control as to the movement of the straightening tool but is also equipped with adjustable supports and rotating device for placing the forgings in the desired strengthening positions.

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Roland J. Houck

first World War, he was first chief yeoman in the Navy, and later second lieutenant in the Army Air Corps. Mr. Houck is survived by his wife, Florence Anselm Houck, and a son, Robert Harry, as well as by his father and mother.

M. T. Mortensen

M. T. Mortensen, connected with the Detroit sales office of the American Foundry Equipment Co., Mishawaka, Ind., died of a heart attack on December 15. He was born in Big Rapids, Mich., on November 6, 1886, and received his early education at Manistee, Mich., completing his apprenticeship in electrical work there in 1906. In 1910, he was appointed works engineer of the Michigan Steel Casting Co., Detroit, and continued with that firm until 1919. During that period, he was associated temporarily with J. J. Wilson, who was then in charge of all General Motors foundries.

In 1919, Mr. Mortensen became connected with the Aluminum Co. of America as works engineer, and in the fall of that year, he joined the foundry equipment department of J. W. Dopp & Co., Detroit, later becoming vice-president. In 1923, he became representative of the W. W. Sly Mfg. Co., Cleveland, Ohio, in the Detroit territory, and remained in that capacity until January, 1939, when he associated himself with the Schmieg Sheet Metal Works of Detroit. In 1940, he joined the sales staff of the American Foundry Equipment Co., filling the post vacated by the death of Hutton H. Haley.

HUGH J. HOMEWOOD, treasurer of the Gisholt Machine Co., Madison, Wis., and affiliated with the company for nearly twenty years, died at his home on November 7 at the age of forty-nine. Prior to his election as treasurer, he had served in various capacities, including chief accountant and office manager, which positions he held for ten years. He is survived by his wife, a son, Tyrus, who is with the Naval Air Corps in Texas, and a daughter.

IRWIN EDWARD LANG, assistant chief engineer of the Pioneer Engineering & Mfg. Co., Detroit, Mich., died suddenly on December 27 at the age of forty-one. Mr. Lang was born in Detroit and attended the Lawrence School of Technology. Before joining the Pioneer organization in 1936, he was associated with the Gemmer Mfg. Co. for seventeen years and with the Detroit Gear Machine Co. for two years. He was a member of the Engineering Society of Detroit and the American Society of Tool Engineers. He is survived by his widow, a son, and a daughter.

WALTER LINLEY HAGUE, who for many years operated the electroplating firm of Walter E. Hague & Son, Inc., which was founded by his father, Walter E. Hague, in 1869, died December 17 at his home in Pittsburgh, aged seventy-one years. Mr. Hague retired some years ago from active business. He leaves a widow and a son, Louis M. Hague, vice-president in charge of sales of the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturer of electroplating equipment.

Coming Events

FEBRUARY 9-11 — INDUSTRIAL RELATIONS CONFERENCE OF THE AMERICAN MANAGEMENT ASSOCIATION at the Palmer House, Chicago, Ill. For further information, address the American Management Association, 330 W. 42nd St., New York 18, N. Y.

FEBRUARY 28-MARCH 3—Spring meeting and committee week of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Netherland Plaza Hotel, Cincinnati, Ohio. For further information, address American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa.

MARCH 26-28—Annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at Philadelphia, Pa. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit 8, Mich.

APRIL 25-28—THIRD WAR PRODUCTION FOUNDRY CONGRESS AND FOUNDRY SHOW of the American Foundrymen's Association, to be held at the Memorial Auditorium, Buffalo, N. Y., in conjunction with the forty-eighth annual meeting of the Association. Executive office, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

JUNE 26-30 — Forty-seventh annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Waldorf-Astoria Hotel, New York City. For further information, address American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa.

New Books

TIME-STUDY ENGINEERING. By William H. Schutt. 426 pages, 6 by 9 inches; 124 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $5.

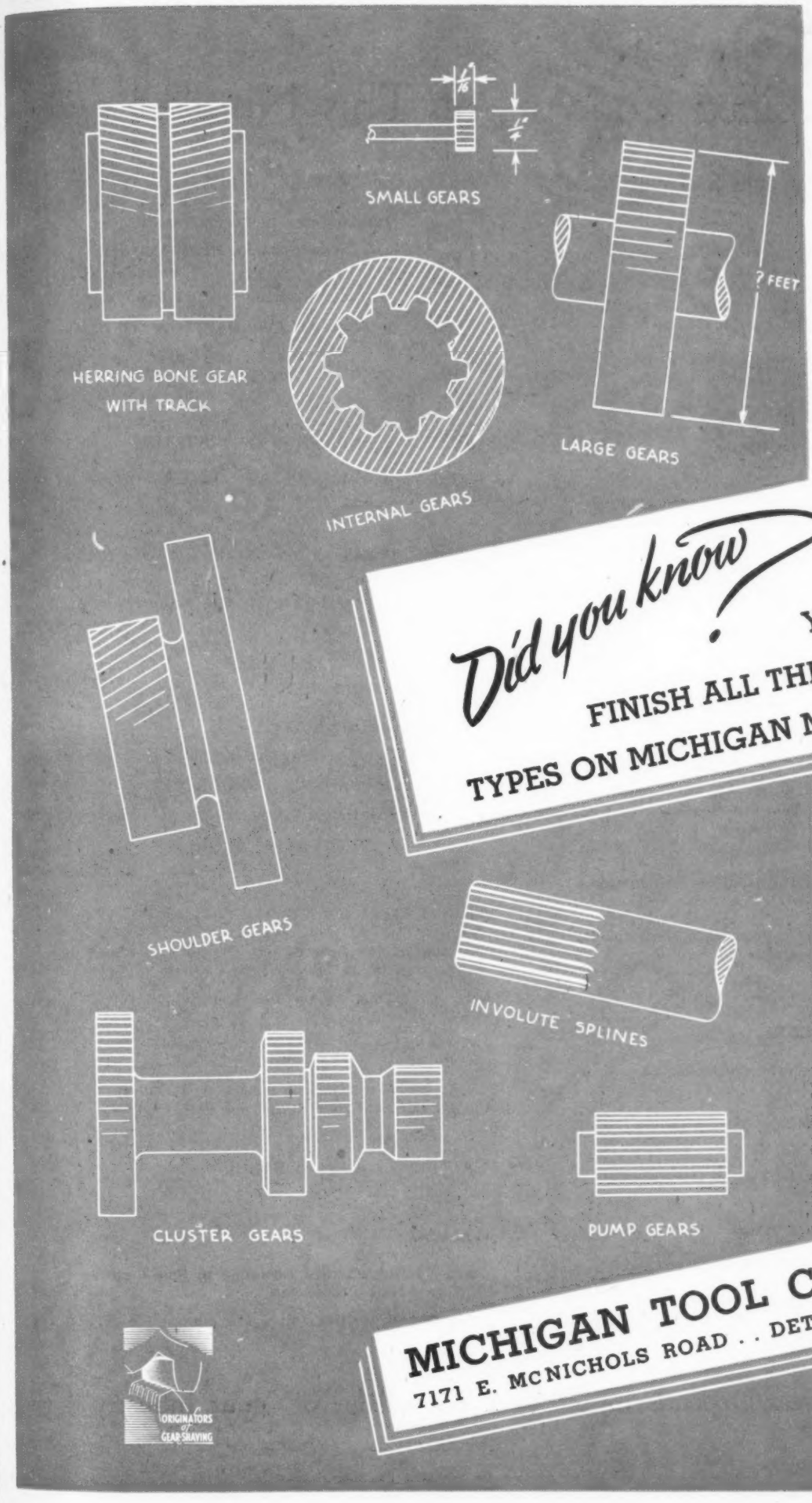
The author has endeavored to present the subject matter of this book in as simple a form as possible, so that it can be understood by anyone, even though his foundation is only a grammar-school education. In addition to being a text-book, it is intended as a handbook for time-study engineers, to assist them in their daily work; and although written from the viewpoint of the methods engineer, any supervisor or executive will find in it many suggestions that apply to his own problems. The book is divided into thirty-two chapters dealing briefly with time-study methods and equipment; motion analysis; efficiency rating; determination of task and price; and studies of numerous special machining operations, covering all the well-known types of machine tools, as well as assembly work and finishing operations, such as plating, etc. One chapter deals with group bonus systems, and another discusses the subject of budget control.

HAND TOOLS. By Albert M. Wagener and Harlan R. Arthur. 174 pages, 5 1/2 by 8 1/2 inches; profusely illustrated. Published by D. Van Nostrand Co., Inc., New York City. Price, $1.75.

This book has been prepared to serve the beginner in shop work, especially those thousands of men and women who are entering the shop today for the first time. Their knowledge of tools is limited and the brief description of these tools, together with illustrations, will prove useful to them.

METALLIZING HANDBOOK. 80 pages; profusely illustrated with photographs and diagrams. Distributed by the Metallizing Engineering Co., Inc., 38-14 Thirtieth St., Long Island City 1, N. Y. Price, $1.

This little handbook covers every phase of the metallizing process, from surface preparation to spraying techniques and the finishing of sprayed metal coatings.



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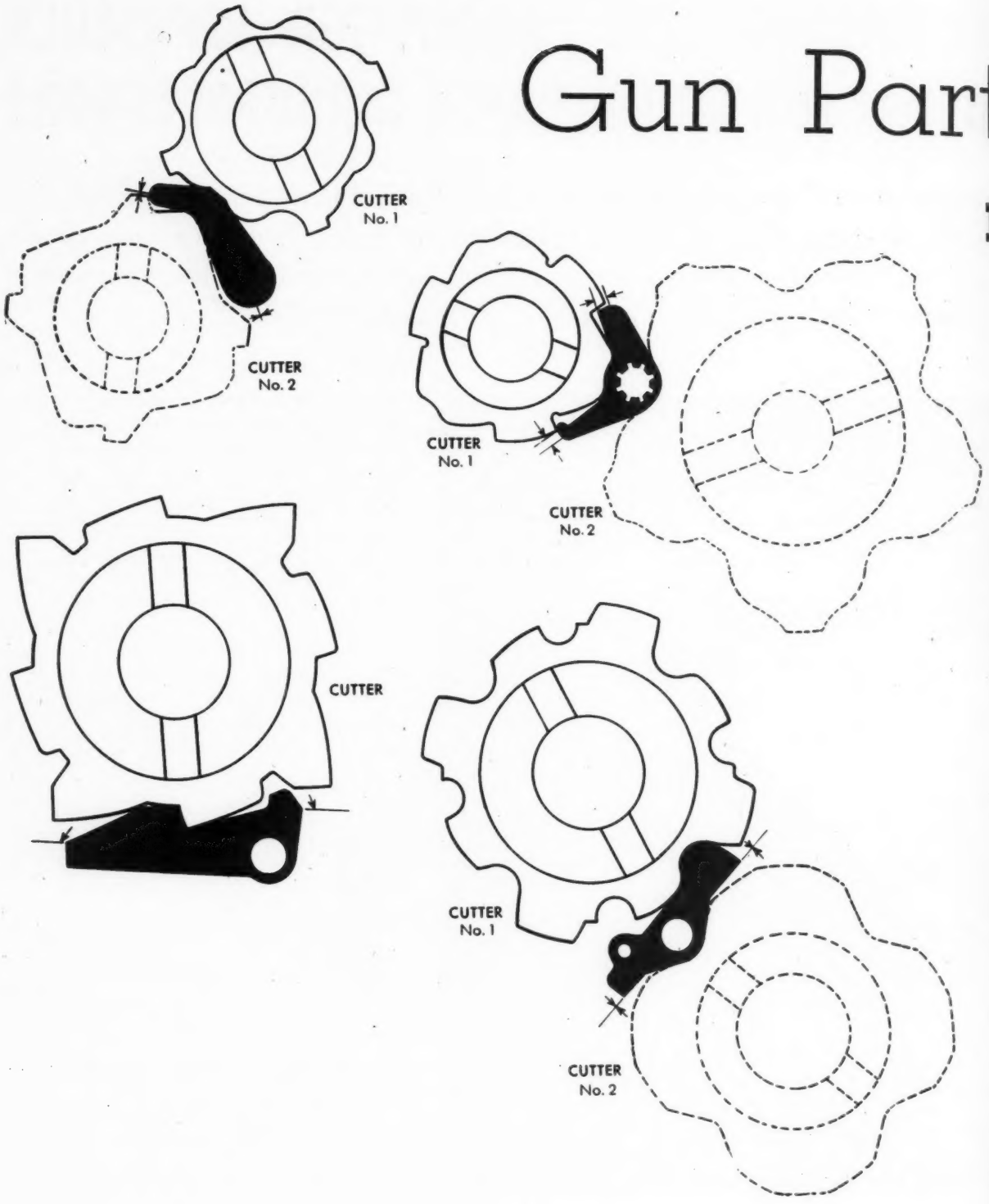
Gun Parts



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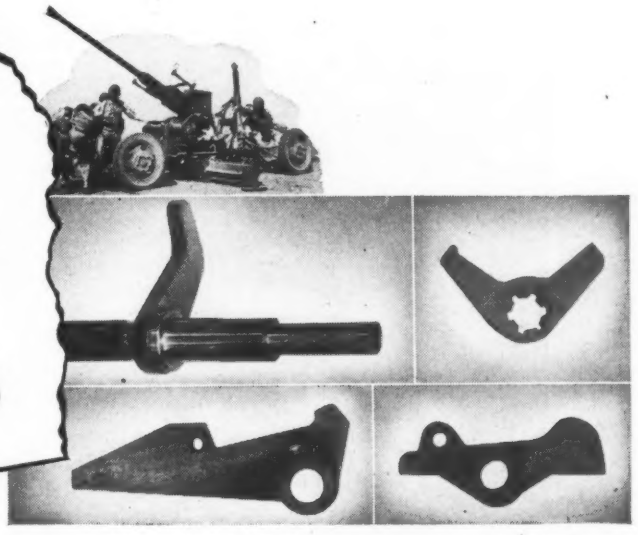

Method

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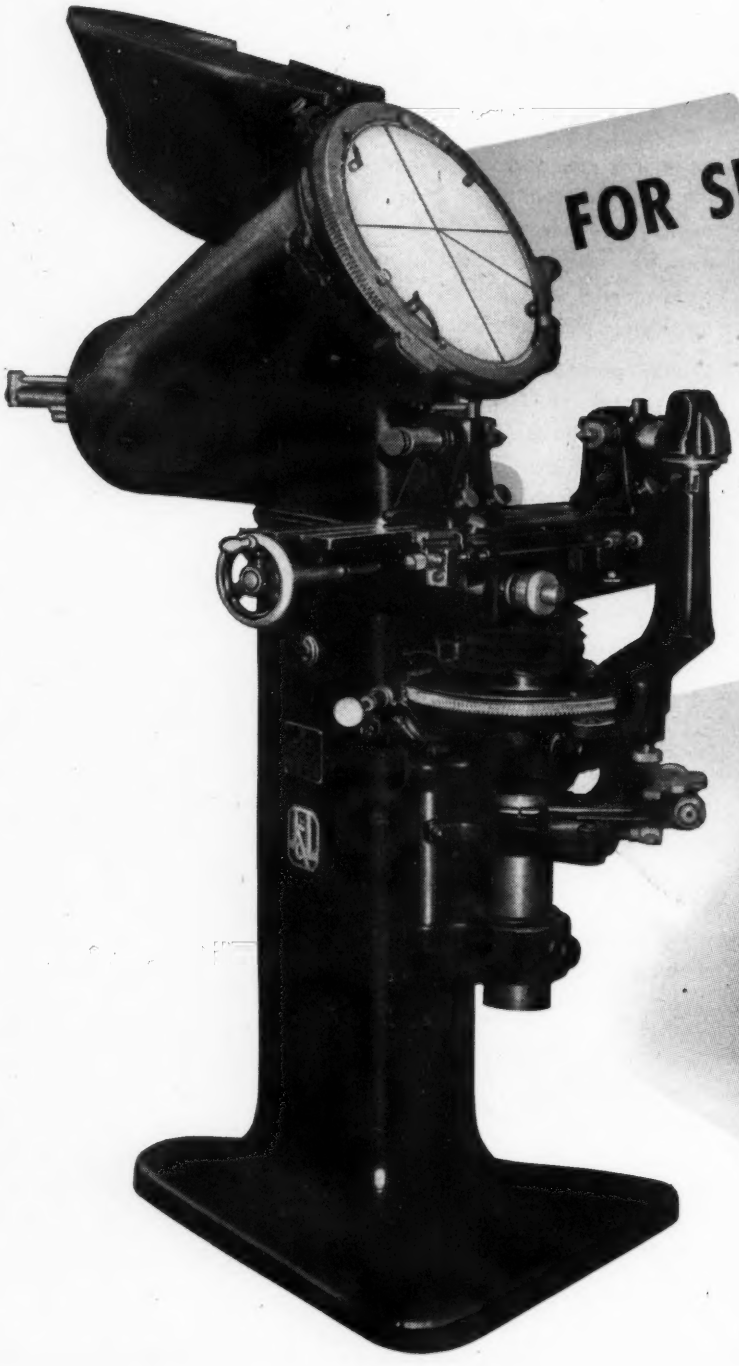

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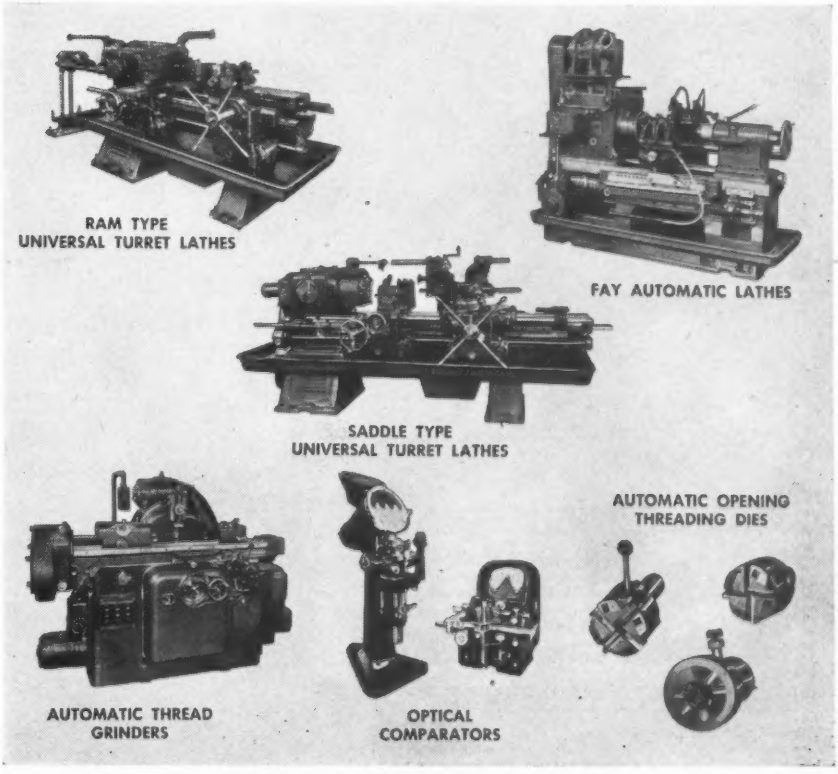
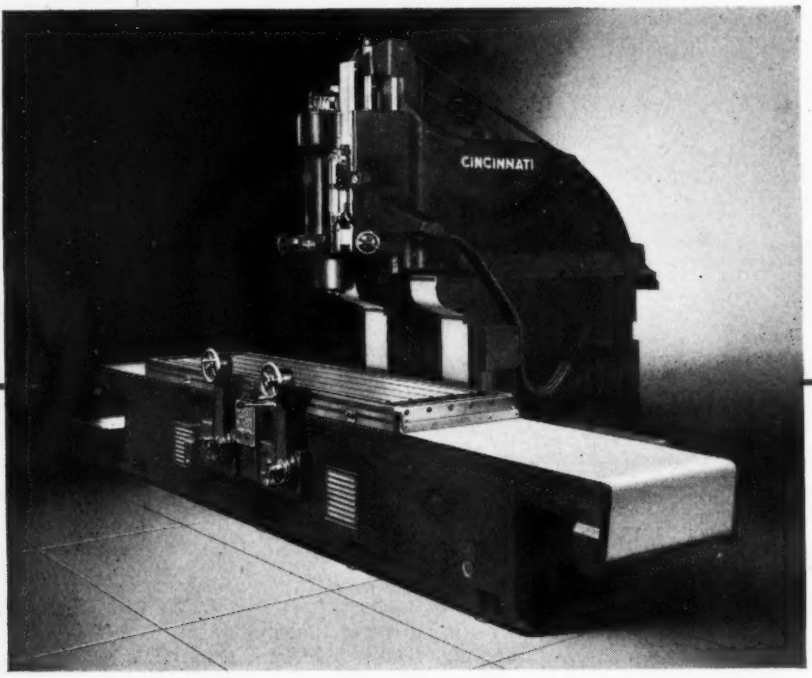


MILLING NINE SLOTS in bearings

WITHOUT RESETTING THE



Front view of the CINCINNATI *28" Series Vertical Hydro-Tel Milling Machine. Specification catalog M-1018-2 gives complete information. For a brief description of this miller, look in Sweet's Catalog File for Mechanical Industries.*

CINCINNATI

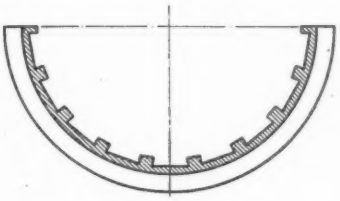
Here a CINCINNATI engineered Universal Index Milling Attachment on a CINCINNATI 28" Series Vertical Hydro-Tel Miller, solved an unusually difficult problem for shipbuilders and their subcontractors. In this operation, dovetail slots are being milled in propeller shaft struts. The attachment is especially desirable because it may be swiveled within a radius of 180 degrees to mill longitudinal grooves or slots on the inside radius of these half-round parts. This method of solving the problem is much faster and simpler than the obvious procedure of readjusting the work from one cut to the next. ¶ The attachment is one of many developed for more rapid production by the engineers here at Milling Headquarters. It will be to your advantage to talk over your milling jobs with this group of authorities. They may be able to work out a more profitable and productive method for handling your milling operations.

Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded February 23, 1943, and the third star September 27, 1943.

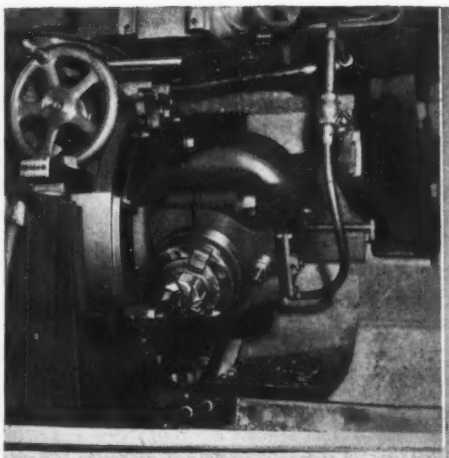
THE CINCINNATI M

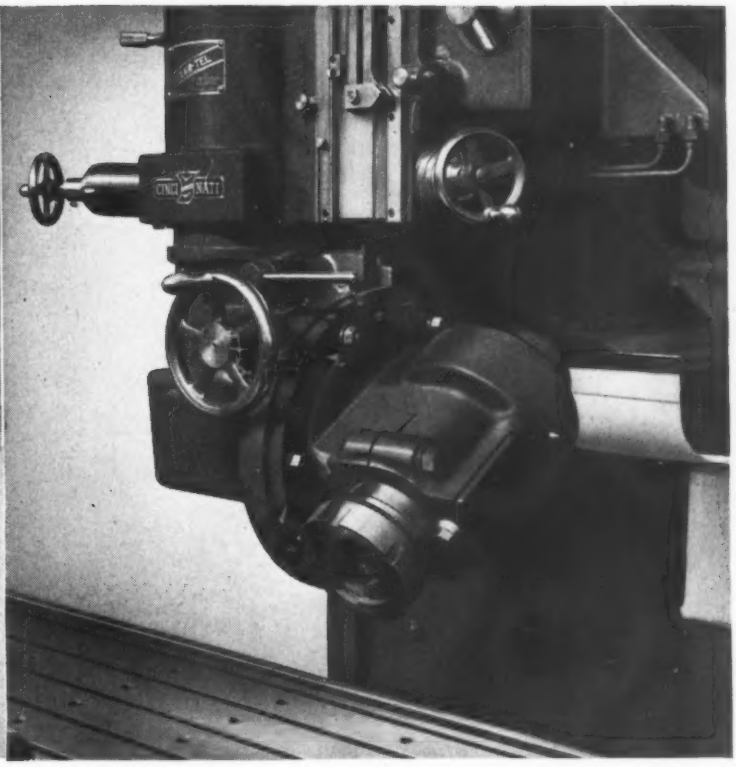
MILLING MACHINES

in sea-going



THE WORK



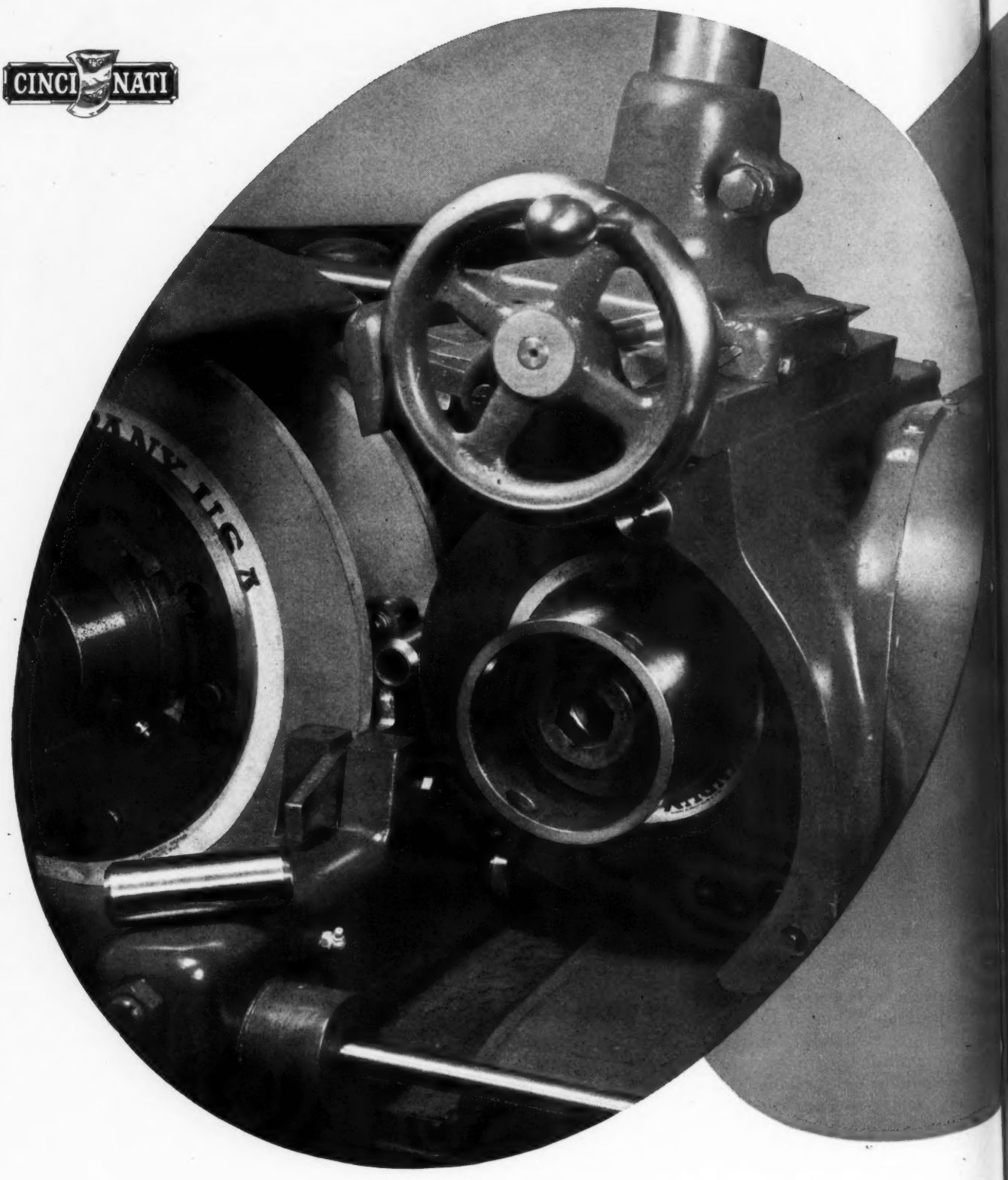


Above is a close-up of the actual milling operation, and a view of the Universal Index Milling Attachment. It has No. 50 standard taper hole; quick change collet; 1½ to 1 speed ratio, index plate for locating angular position of attachment spindle.

MILLING MACHINE CO. CINCINNATI 9, OHIO, U.S.A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

CINCINNATI



Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded February 23, 1943, and the third star September 27, 1943.

CINCINNATI

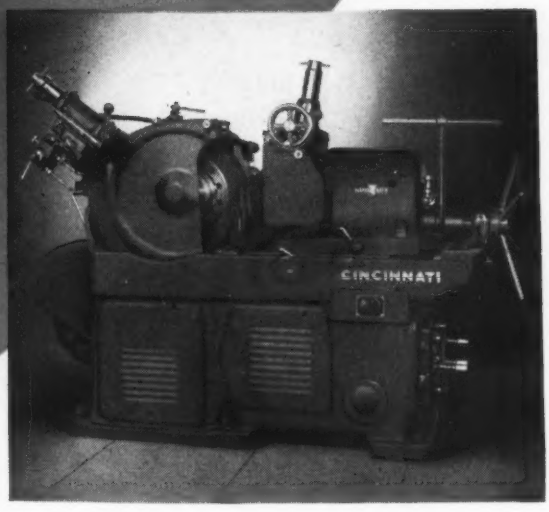
CENTER TYPE GRINDING MACHINES

A two-wheel job!

CENTERLESS GRINDING two bevels at the same time

Grinding a bevel on each end of piston pins for aviation engines. This is an infeed grinding job with work-rest equipped with a hold-down roller. Both bevels are ground at the same time. Machine is arranged for profile truing bevels on each of the two one-inch wheels. The machine is a No. 2 Centerless.

Below is illustrated the CINCINNATI No. 2 Centerless. Catalog C-456-1 gives complete information and specifications. A copy will be sent on request.



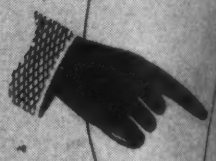
Production time reduced from minutes to seconds. That's the story of the part CINCINNATI Centerless Grinding Machines have played in stepping up the manufacture of war essentials. A good example is shown in the illustration at the left. ¶ And the tremendous productive capacity of these grinders, so effectively demonstrated during this emergency, will again be available for precision grinding countless components of peacetime products. Literally thousands of cylindrical and spherical parts are now ground quickly and accurately on these machines . . . parts made of all types of metal and metal substitutes — of glass, cork, wood, plastic, rubber, ceramics and other materials. ¶ You will be wise to investigate today. The engineers here at Grinding Headquarters will be glad to discuss your precision grinding requirements. ¶ Sweet's Catalog File for Mechanical Industries gives a brief description of these machines. For complete details and specifications, write for catalog G-456-1.

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

MEET YOUR POST-WAR PRODUCTION DEMANDS WITH Firthite!



FIRTHITE SINTERED-CARBIDE PUNCHES AND DIES WILL GIVE YOU:

Better Product

Less burring, distortion, and buckling; more uniform accuracy; better finish—smoother edges and surfaces.

Longer Life

Edges stay sharp longer; resist chipping and breaking. Life multiplied many times!

More Production

Less idle time for changes.

Greater Economy

Lower cost of maintenance; fewer resharpenings than any steel dies.

Firth-Sterling

STEEL COMPANY

Offices: McKEESPORT, PA. NEW YORK - HARTFORD - PHILADELPHIA - CLEVELAND - DAYTON - DETROIT - CHICAGO - LOS ANGELES

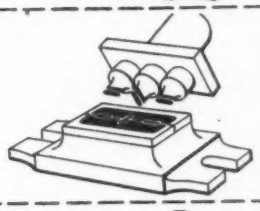
Makers of High-Speed Steels, Tool and Die Steels, and Sintered Carbides

FIRTHITE PUNCHES AND DIES FOR:

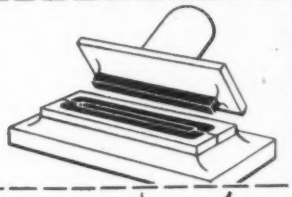
★ PERFORATING

★ BLANKING

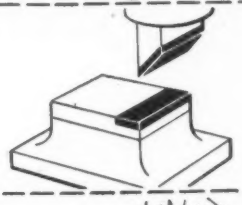
★ SLOTTING



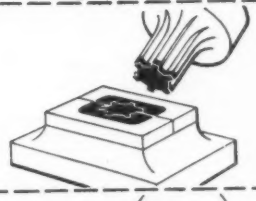
★ SLITTING



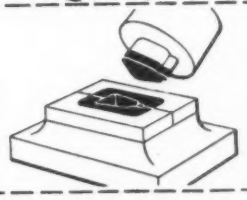
★ CUTTING OFF



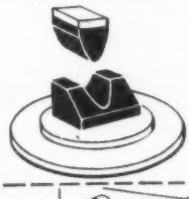
★ SHAVING



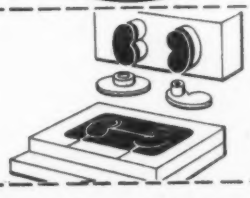
★ NOTCHING



★ FORMING OR BENDING



★ TRIMMING



also laminating, burnishing, curling, piercing, crimping, planishing, broaching, swaging, etc.

Please furnish this information when you request quotation on Firthite Punches and Dies:

Assembly blue print of present method;
Detail blue print of existing punches and dies;
Description of material punched;
Type of press (full details);
Type of die holder, sub-plate details, etc.

ARMY E NAVY

Firth-Sterling
STEEL COMPANY
Offices: McKEESPORT, PA. NEW YORK - HARTFORD
PHILADELPHIA - CLEVELAND - DAYTON - DETROIT
CHICAGO - LOS ANGELES

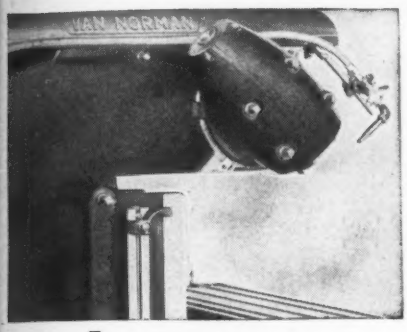
SPECIFICATIONS

No. 36 UNIVERSAL MILLER. Table 58" x
speeds: 30 to 1500 rpm. 18 feeds:
Range: 35" longitudinal, 12" cross, 22¼"

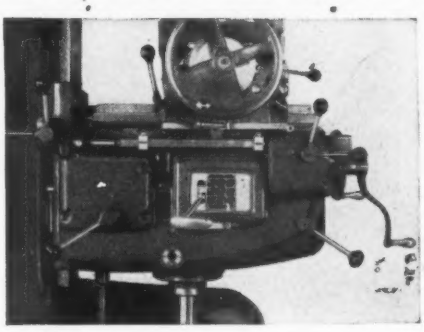
...IT PAYS TO

VAN NORMAN ADVANTAGES

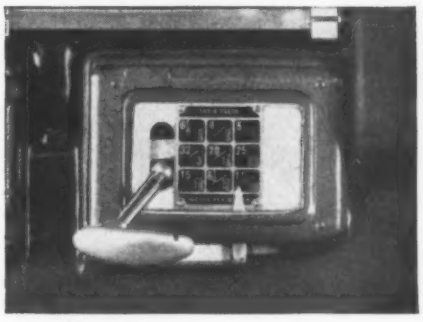
that speed up production on RAM TYPE UNIVERSAL MILLING MACHINES



1 ADJUSTABLE CUTTERHEAD



2 FRONT AND REAR DIRECTIONAL CONTROLS



3 SINGLE LEVER FEED SELECTOR

Van Norman Ram Type Universal Millers provide operators with three distinct operating advantages that increase work accuracy, minimize work reset-ups, lessen worker's fatigue and speed production.

1. The *adjustable cutterhead* gives you precision horizontal, angular or vertical milling by simply swinging the cutterhead to the desired milling position. This feature enables operators to perform most milling operations without changing the original work set-up. It saves valuable man and machine hours because there is no waiting for other types of millers to become available and changing the work from one miller to another is eliminated.

2. *Front and rear directional controls* of all power feeds, including the 6-way rapid traverse, enable the operator to operate the machine from either the front or rear of the machine thereby providing greater work visibility. These controls operate in the direction of the table, saddle or knee movement thus the operator always knows that the unit will move in the direction that the lever is positioned.

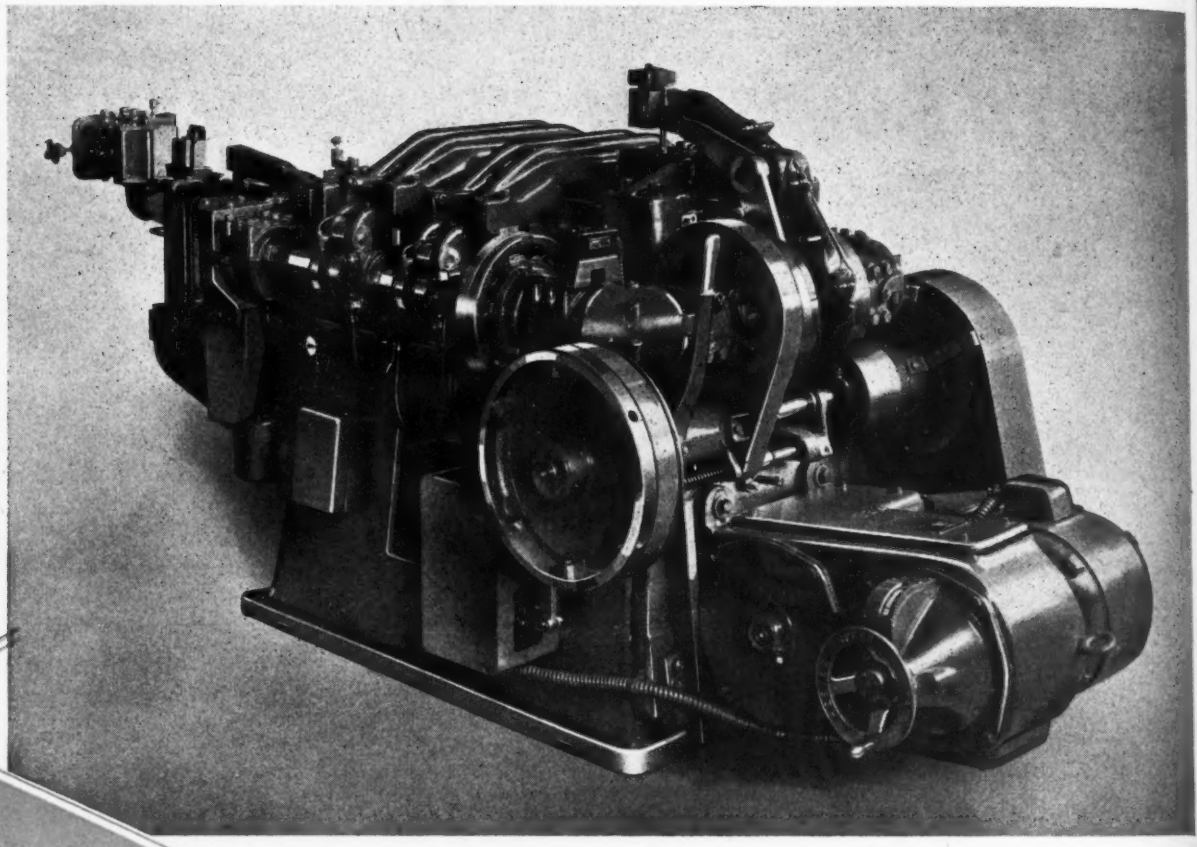
3. The *exclusive single lever feed selector* provides quick convenient selection of 18 feeds from 3/8" to 32" rpm. on No. 36 illustrated. The operator merely moves the selector lever up or down and right or left to the desired speed indicated by the coincidental pointer on the direct reading dial. A quick change speed selector, located on front of ram provides 18 speeds from 30 to 1500 rpm.

VAN NORMAN COMPANY

Springfield, Massachusetts

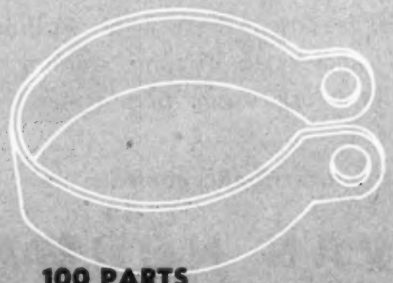
VAN NORMANIZE

Automatic Production o
from Coil Stock with t



The drawings below illustrate in actual sizes some interesting applications.

270 PARTS PER MINUTE (3 PARTS AT A TIME)



100 PARTS PER MINUTE

# of INTRICATE Metal Parts

the U.S. Multi-Slide

IF your production program involves the fabrication of intricate metal parts calling for piercing, blanking, forming, swaging, and embossing operations, the U. S. Multi-Slide Machine should be of particular interest to you.

These machines are made in a number of sizes to accommodate stock of various widths, thicknesses, and feed lengths. Each standard Multi-Slide is equipped with four slides, one stripper, and one die head which are cam operated from the shaft system. The die head accommodates a die set in which may be mounted piercing, trimming and preliminary forming tools. The slides accommodate the final forming tools.

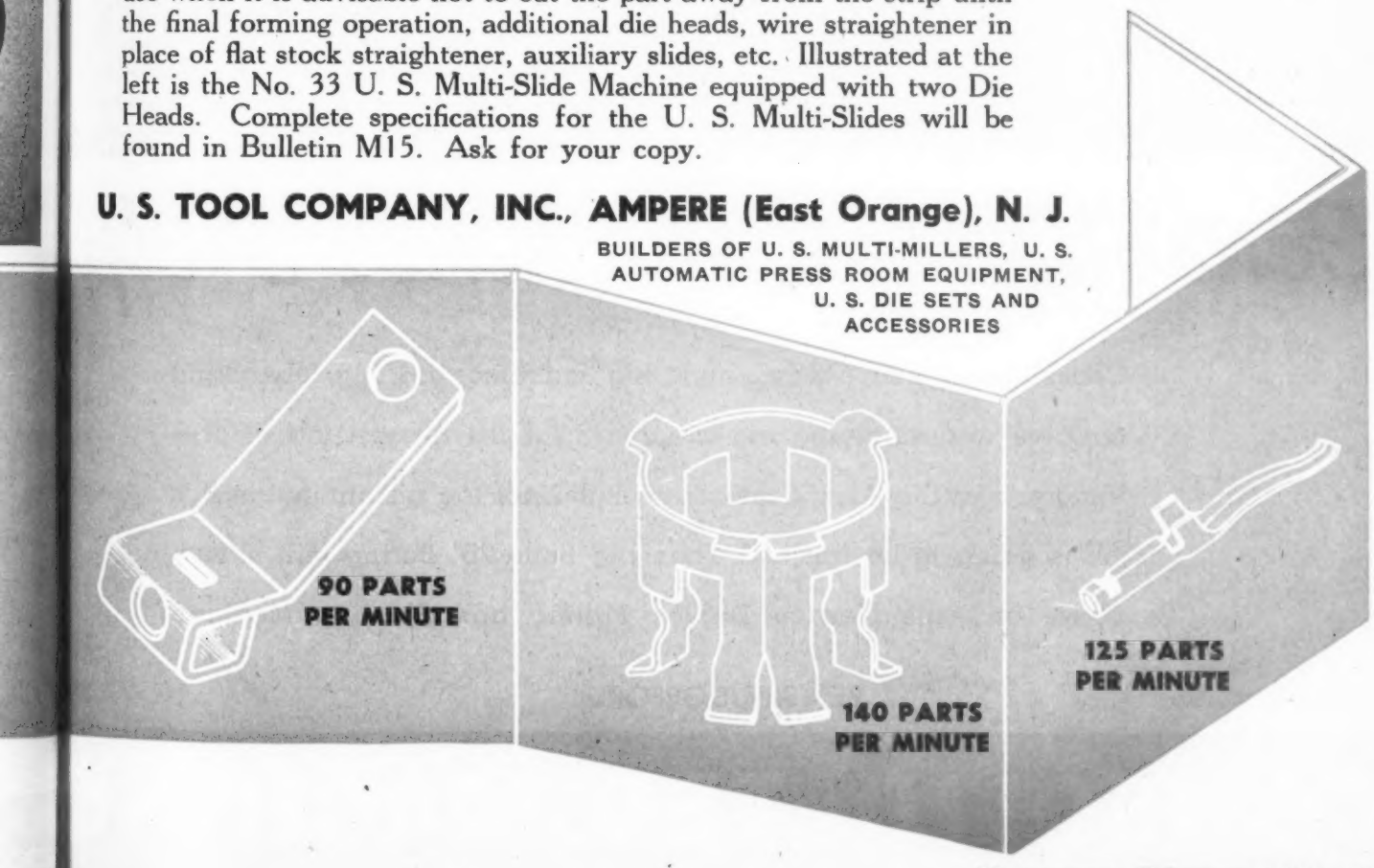
Many jobs can be handled on the machines with standard equipment. The nature of certain parts, however, necessitates auxiliary equipment such as: Toggle Press or Lever Press on the larger machines (for heavy duty swaging and embossing operations), cut-off slide for use when it is advisable not to cut the part away from the strip until the final forming operation, additional die heads, wire straightener in place of flat stock straightener, auxiliary slides, etc. Illustrated at the left is the No. 33 U. S. Multi-Slide Machine equipped with two Die Heads. Complete specifications for the U. S. Multi-Slides will be found in Bulletin M15. Ask for your copy.

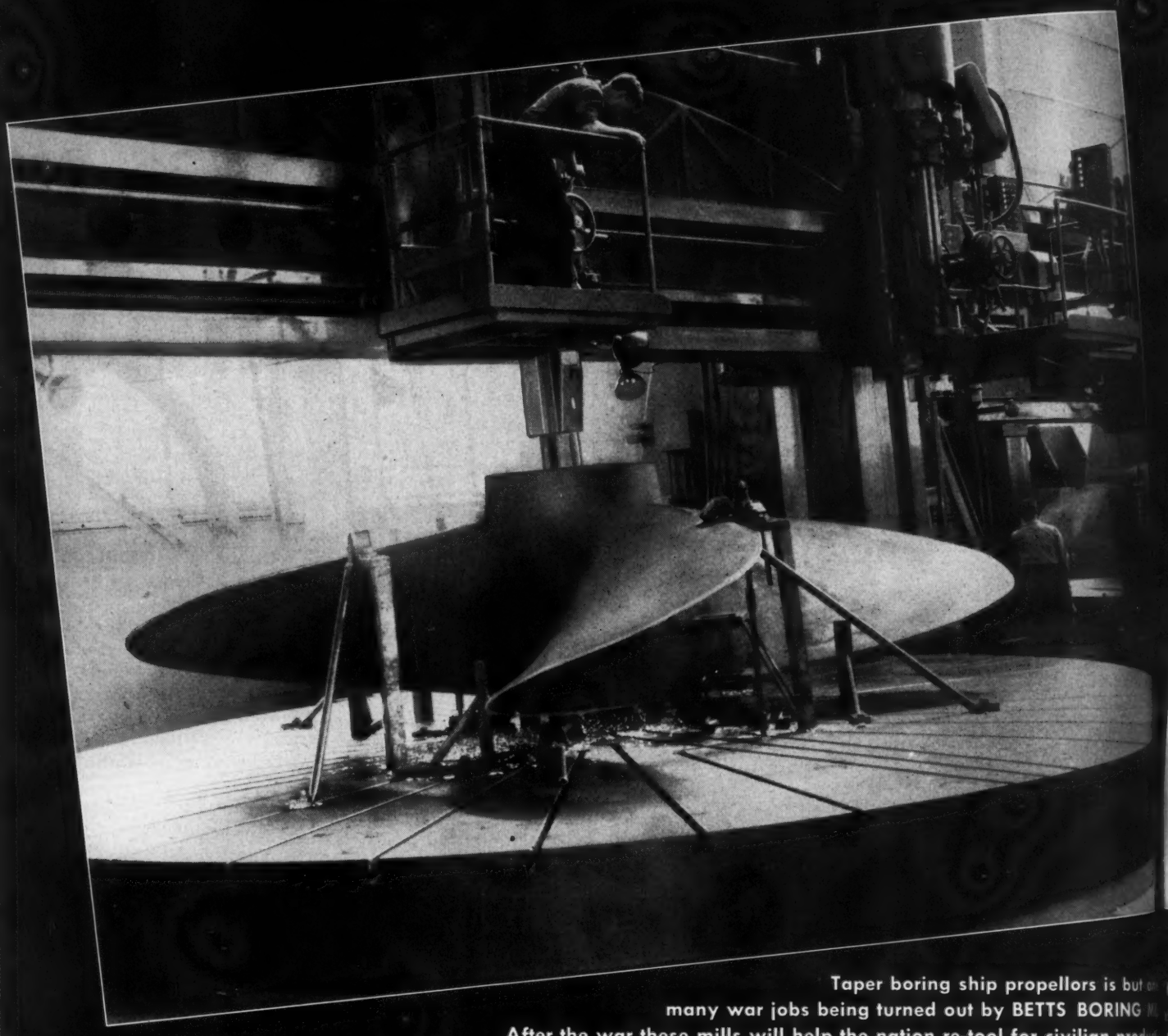
Types of Parts Handled to Advantage on the U. S. Multi-Slide

Metallic Belt Links for holding machine gun bullets
Automobile Accessories
Parts for Office Machines
Radio and Radio Tube Parts
Electrical Appliances
Hardware Specialties
Safety Razors
Book Bindings
Electrical Contactors
Kitchen Utensils
Bearings
Automatic Pencils

U. S. TOOL COMPANY, INC., AMPERE (East Orange), N. J.

BUILDERS OF U. S. MULTI-MILLERS, U. S. AUTOMATIC PRESS ROOM EQUIPMENT, U. S. DIE SETS AND ACCESSORIES





Taper boring ship propellors is but o
many war jobs being turned out by BETTS BORING M
After the war these mills will help the nation re-tool for civilian produ

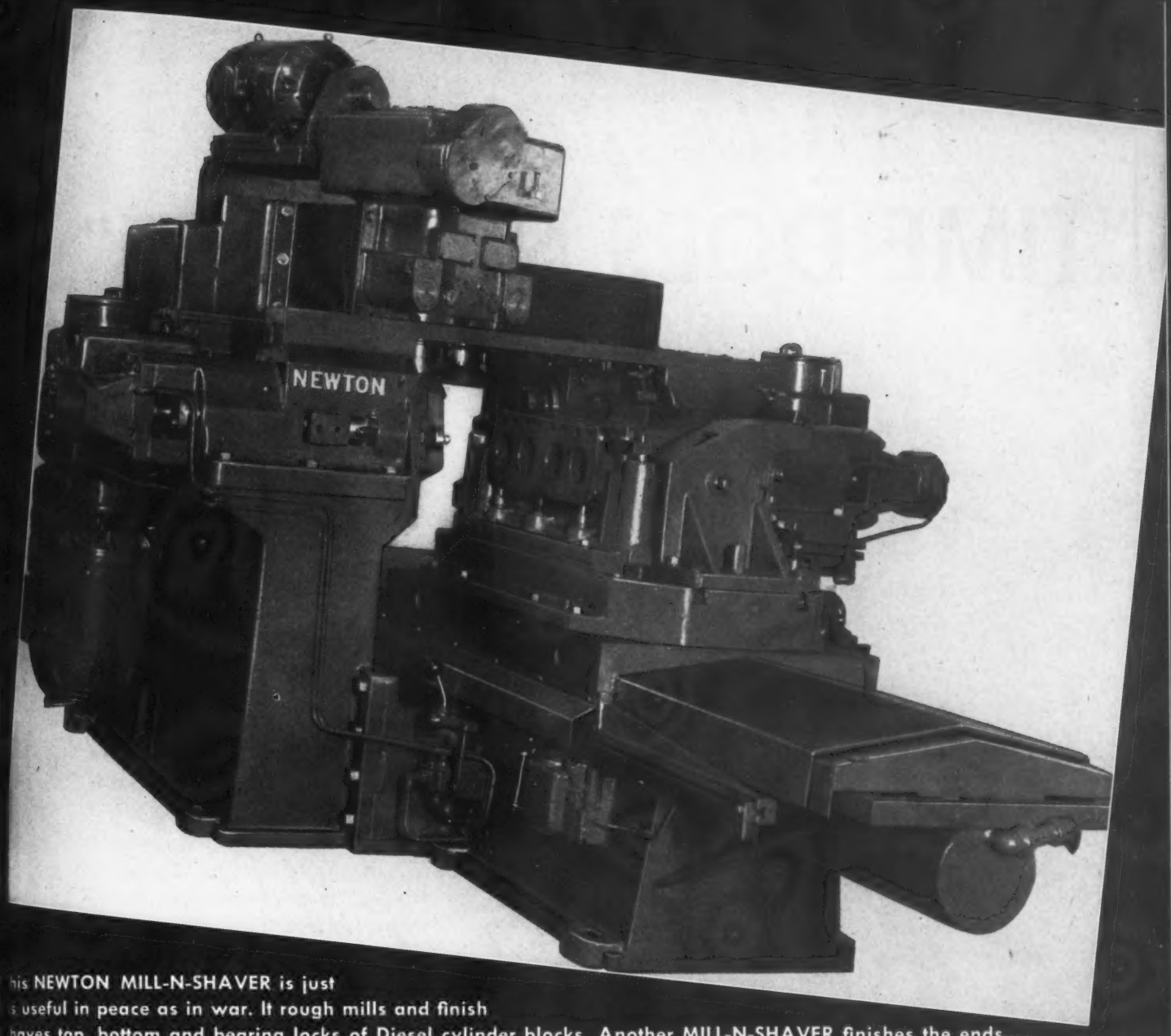
Consolidated Machines Help

Consolidated has always built big machines for big jobs. Right now we are supplying big machines for the biggest job of all—Victory over the Axis. Some day in the not too distant future this job is going to be finished. Then big Betts 25' Boring Mill shown above and the Newton Duplex Milling and Shaving Machine

BETTS BETTS-BRIDGEFORD NEWTON

CONSOLIDATED MACHINE

ROCHESTER 10



his NEWTON MILL-N-SHAVER is just
s useful in peace as in war. It rough mills and finish
haves top, bottom and bearing locks of Diesel cylinder blocks. Another MILL-N-SHAVER finishes the ends.

Pave the Way to VICTORY

opposite will turn from production for war to production for peace. We'd like you to remember that Consolidated makes practically any type of big machine tool you will need for peace-time production. As you make your plans for the future, we invite you to contact us for any advice or information you may require.

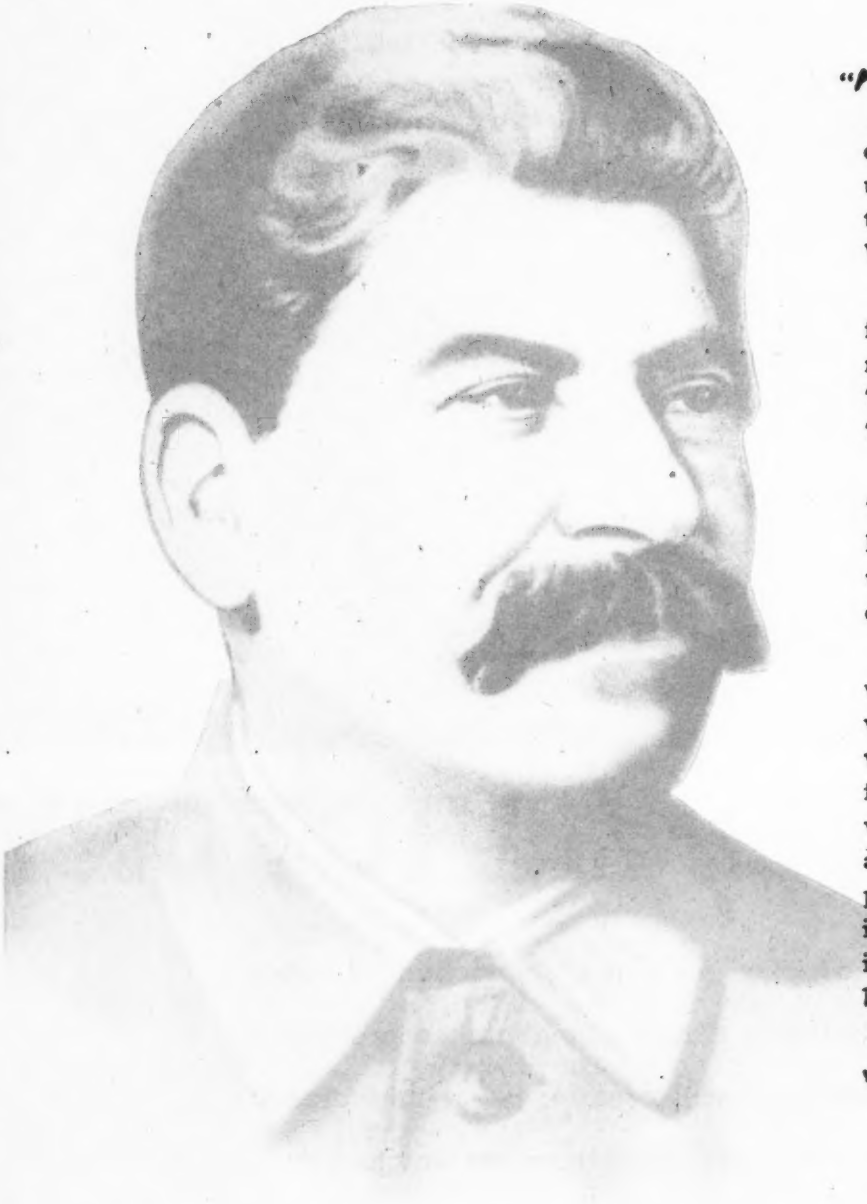
COLBURN HILLES & JONES MODERN

TOOL CORPORATION

10 NEW YORK

— then he said to himself

"TIME DOES NOT WAIT"



"THE foe cannot be beaten," says Joseph Stalin, "if his forces of today, fully developed to the utmost, are opposed by forces of tomorrow . . . **TIME DOES NOT WAIT.**"

So, by having recourse to the forces of tomorrow **TODAY** . . . he makes **NEWS** . . . he achieves **TRIUMPHS** . . . he dictates **HISTORY.**

"Developing tomorrow's force TODAY" can well be the motto hanging in every conference room where factory committees are discussing postwar procedures.

And under that motto these words: "Our ship, tank, plane, weapon industries are TODAY working with tomorrow's greatest forces for production. Come re-conversion to peacetime products, they are in practiced strategy to outproduce and underprice all competitors who have the temerity to go into postwar production with day-before-yesterday's techniques."

"Even if you had the time—don't wait for time."

"TIME DOES NOT WAIT"... *he says*

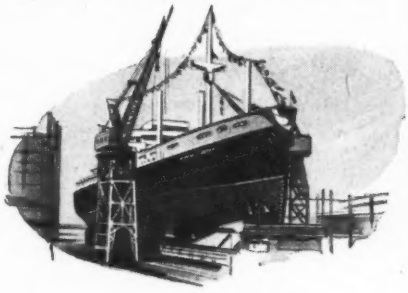
Look, Mr. Stalin, how through *recourse to Arc Welding* you can tweak time's forelock.

Similar time savings gave you tomorrow's force today.

Arc Welding, of course, will not win the war for you . . . but lack of Arc Welding could have lost it for you.

And that thought might well be another motto for each postwar planning room.

DAYS instead of MONTHS



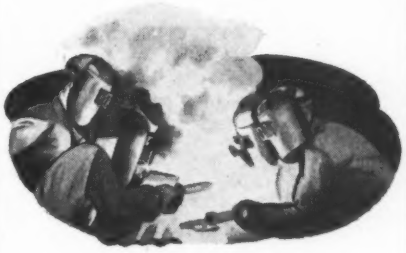
Easily the margin between Victory and defeat—for you and the United Nations—is putting ships on the water *6 times faster*.

LAST WAR "Liberty" size ship 300 DAYS
THIS WAR they average under 50 DAYS

Recourse to Arc Welding in 2 years has put to work 2000 more ships than possible under old standards—thus saving the necks that Old Methods would have lost—yours and ours.

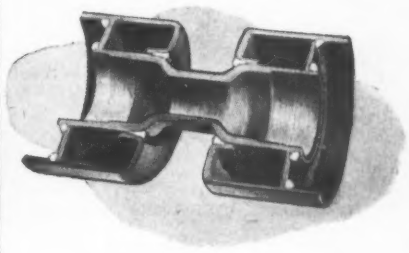
Think *that* one over!

HOURS instead of WEEKS



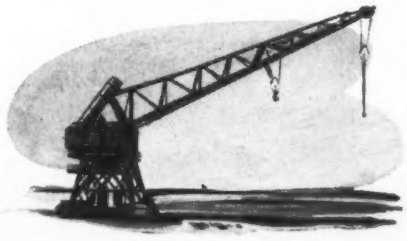
A sit-down in a steel plant lasting for weeks would be a headline SCREAM in Pravda and every newspaper in the world. That catastrophe was averted by *recourse* to Arc Welding when these six welders repaired the break of a vital steel mill part in 8 hours. Replacement would have taken weeks . . . thus sabotaging the output of a hundred war producers. Think that one over too—in terms of providing *recourse* to help in trouble.

MINUTES instead of HOURS



Half-track parts at half-time speed . . . these are typical of machine parts which *recourse* to Arc Welding helped rush to first and second fronts. Processing cost cut from $11.00 to $6.64. Machining cost cut from $3.50 to $1.25. Weight cut from 27½ to 24 lbs. Time cut 45%. This cutaway picture is to help you think over what *recourse* to Arc Welding will do to the cost of any part of any of your machines.

MINUTE-MEN of production cut MAN-HOURS on every job



This 28-ton revolving crane which literally gives the *lift* to America's ultra-speedy shipbuilding industry—gets to the job 1,584 MAN-HOURS SOONER through *recourse* to Arc Welding.

FABRICATED . . . 23.5% FASTER
ERECTED . . . . . 21% QUICKER
than by riveted construction.

THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

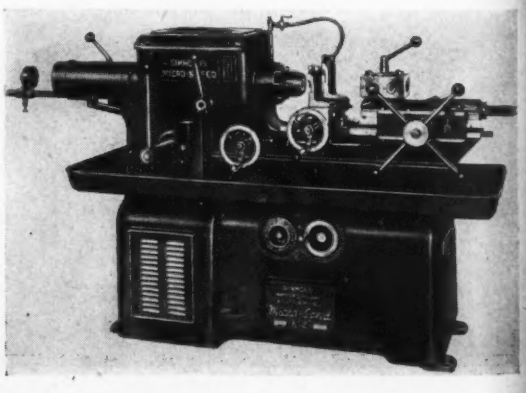
America's greatest natural **recourse**

ARC WELDING

For War or Peace... A DEPENDABLE TURRET LATHE

Simmons No. 2 Turret Lathe, Drawn by Lili Rethi

★ "Enthusiastic" is the word that best fits the reception given to the Simmons No. 2 Turret Lathe—both in volume of sales and satisfaction—since it was first placed on the market several years ago. ★ Here's the reason: Simmons set out to manufacture a precision turret lathe *low in cost, sturdy and simple to operate.* In its construction many "gadgets" and devices have been eliminated that might be required only on rare operations, complicate the instruction of new operators, and require unnecessary service attention. ★ How well these objectives have been attained can be determined by the enthusiastic comments received from the hundreds of satisfied users, among them Bendix Radio Corporation, Cessna Aircraft Company, Fairchild Aircraft, Ltd., Sterling Engine Company, Swift Lubricator Company, Dominion Engineering Corporation, Ltd. ★ Why not investigate for yourself the merits of this unusual machine tool. It has 1¼″ bar capacity, 14″ swing, Micro-Speed Drive with a range of 1,000 spindle speeds, Timken Bearings, spindle brake and clutch. Simmons Machine Tool Corporation, 1600 North Broadway, Albany 1, New York.



Simmons-Built MACHINE TOOLS

PHOTO COURTESY BELL AIRCRAFT CORP.

OUTSTANDING PERFORMERS

In aircraft plants from New Jersey to California, "American" Hole Wizard Radials are proving their reputation as outstanding performers on exacting jobs. On drilling, tapping, boring and facing they are hanging up records for quantity and quality production — records that are making it possible for American planes to overwhelm the Axis in every branch of aerial warfare.

THE AMERICAN TOOL WORKS CO.

LATHES RADIALS SHAPERS

CINCINNATI OHIO

Army P-39 Airacobras like the one shown above are fighting for you on every front. They'll keep on fighting if we keep 'em flying! Buy War Bonds and Stamps every payday!

More working space—
More productive welding time

. . . with an Airco pipeline gas distributing system

Here's graphic evidence of how an Airco pipeline gas distributing system increases the productivity of the modern welding shop.

At top is the welding department of Bell Aircraft Corporation, Buffalo, N. Y., showing the new piping system that supplies hydrogen, oxygen, and acetylene gas direct to each welder's table. At left is the same shop before the pipeline was installed.

The removal of cylinders from the work area to a central supply station, made available an additional 600 sq. ft. of working floor space. Moreover, the new system relieved welders of the job of changing cylinders, connecting and disconnecting regulators, setting-up and similar time-consuming tasks. As a result, each welder gained an average of ½ hour additional productive time per day.

The advantages offered by this modern method—in terms of reduced cylinder handling, increased welding productivity, more economical operation—are equally desirable for large and medium sized plants.

Air Reduction's Applied Engineering Department will be glad to survey your plant and submit detailed plans—including estimated costs—for complete gas distributing systems and cylinder manifolding arrangements. This service is available without charge through your nearest Air Reduction office.

Send for free booklet: "Planning Your Oxyacetylene Installation" describes operation of manifolds and acetylene generators; describes pipeline operating and safety devices. Typical plant piping layouts are described. Get free copies through your Air Reduction office.

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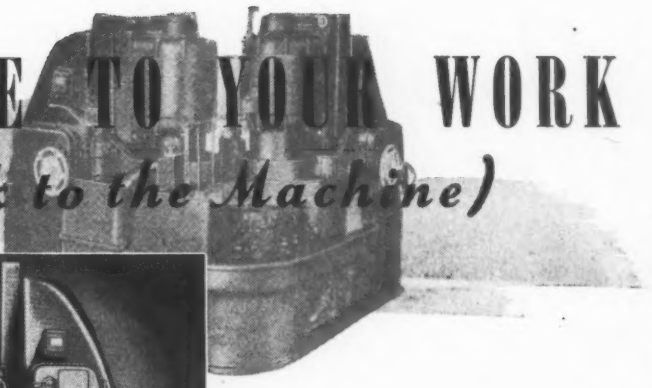
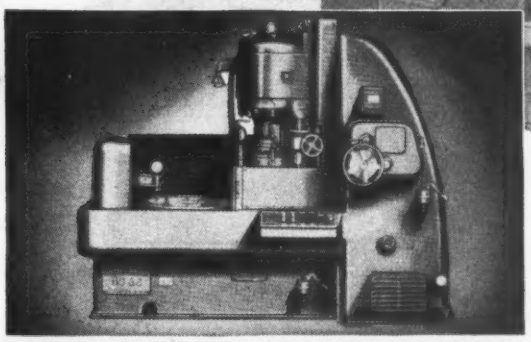
FIT THE MACHINE TO YOUR WORK

(Not Your Work to the Machine)



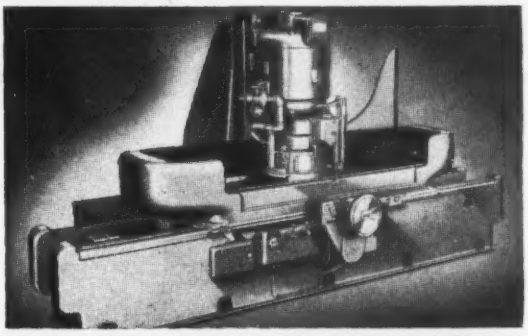
ROTARY TABLE TYPE SURFACE GRINDER

Grinds several relatively small pieces simultaneously at a high rate of production. Also efficient on single pieces.



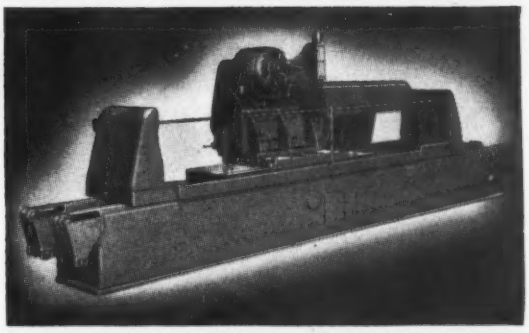
RECIPROCATING TABLE TYPE SURFACE GRINDER

Principally used for grinding long, narrow pieces singly or in groups.



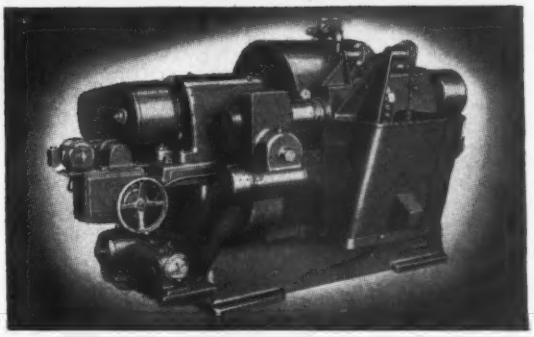
HYDRAULIC TRAVELING TABLE FACE GRINDER

A new, practical, time- and money-saving method of machining quality finishes on a wide variety of work.



DOUBLE SPINDLE DISC GRINDER

For high-speed grinding of two opposite parallel faces at the same time.



PEAK surface grinding efficiency comes only from using the right type of grinder for the job. Too often a compromise results in unsatisfactory production rates, difficulty in obtaining specified finishes, unnecessarily high grinding costs and delayed deliveries. Why not place the responsibility of determining just which type of surface grinder will most efficiently handle your work in the hands of Hanchett engineers? They are in a position to give you unprejudiced judgment because Hanchett builds a complete line of surface grinders of all types.

Write today—ask for Catalog No. 170 M-4

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

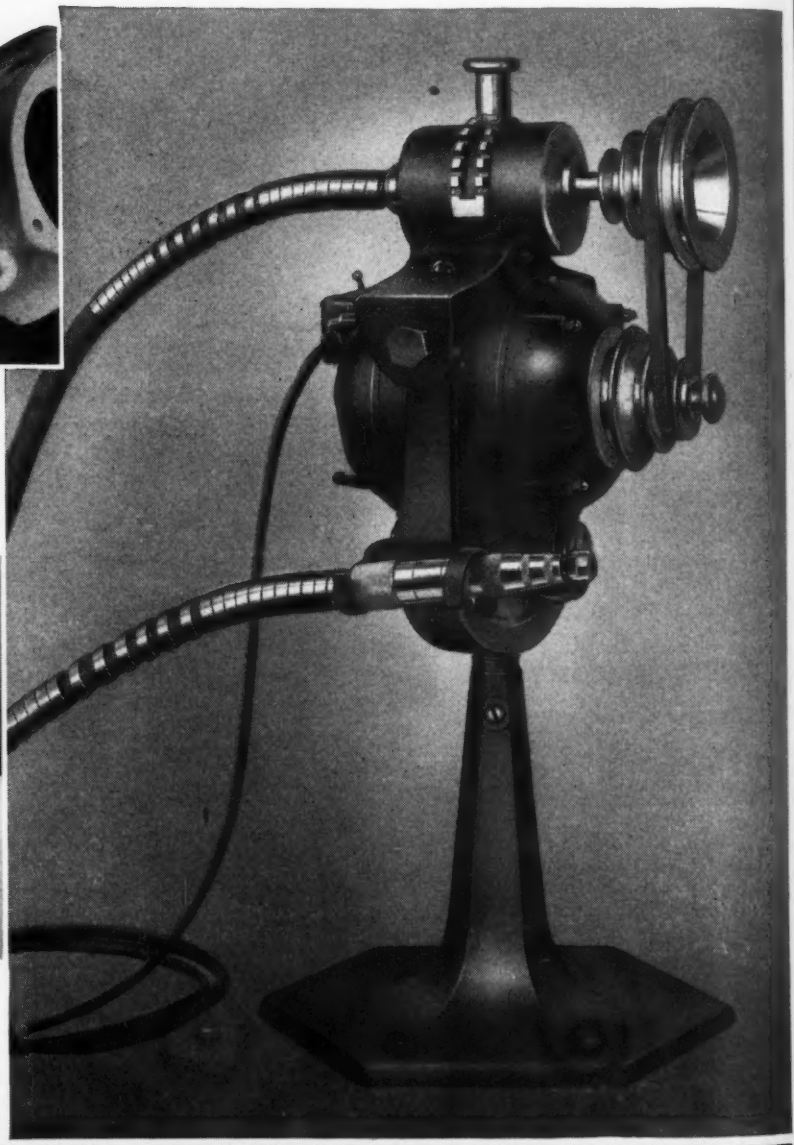
HANCHETT MANUFACTURING CO.

BIG RAPIDS, MICHIGAN U.S.A.

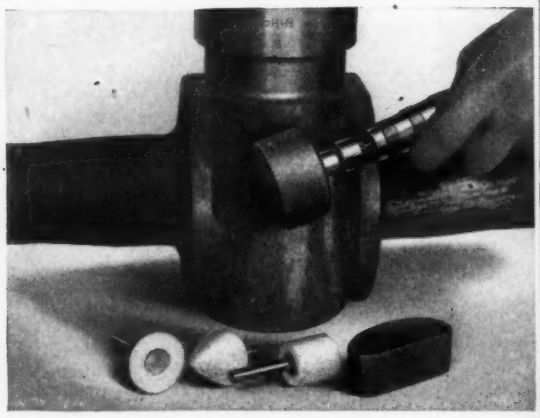
Jarvis Flexible Shaft Machines

Jarvis Multiple-Speed Flexible Shaft Machines make it possible for the metal craftsman, the finisher, and the cleaner to have a universal tool suitable for rotary filing, sanding, grinding, polishing, and buffing. There are Jarvis Flexible Shaft Machines and Tools that will satisfactorily meet your requirements.

Write for our new catalog MFTI.



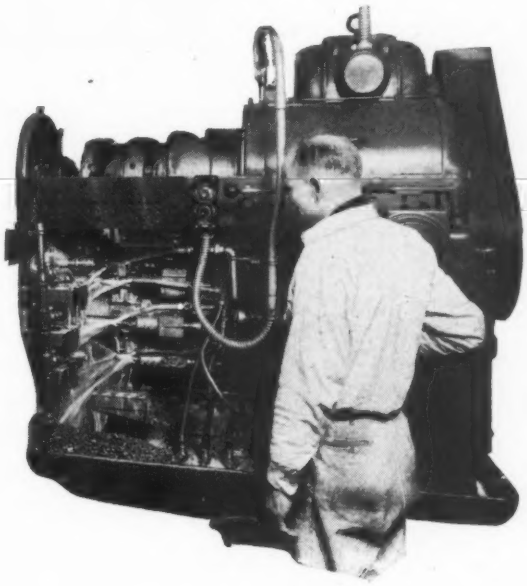
Jarvis Flexible Shaft Machines are used extensively in the aircraft engine industry and aluminum foundries; also in mold and metal pattern shops.



Jarvis Tools are made for efficiency and long life. For use with Jarvis Flexible Shaft Machines, in any finishing or cleaning operation.

THE CHARLES L. JARVIS CO., MIDDLETOWN, CONN.

TAPPING ATTACHMENTS • FLEXIBLE SHAFT MACHINES • GROUND ROTARY FILES



We Stand Ready to Prove This Statement . . . PERFECTED LUBEWELL CUTTING COMPOUND WILL INCREASE TOOL LIFE UP TO 50% REGARDLESS OF THE MACHINE TOOL OR TYPE OF WORK BEING DONE.

To prove that tool conservation begins by adding life to tools through proper lubrication, G. Whitfield Richards will ship you any quantity of Perfected Lubewell, and if you do not find that it: **1.** Increases tool life up to 50%; **2.** Increases machine production up to 25%; **3.** Gives a superior finish and closer tolerances; **4.** Lowers cutting lubricant cost as much as 40% . . . then you may tear up the bill. . . . Phone, write or wire a trial order of Perfected Lubewell. Try it on your toughest job.

G. WHITFIELD RICHARDS

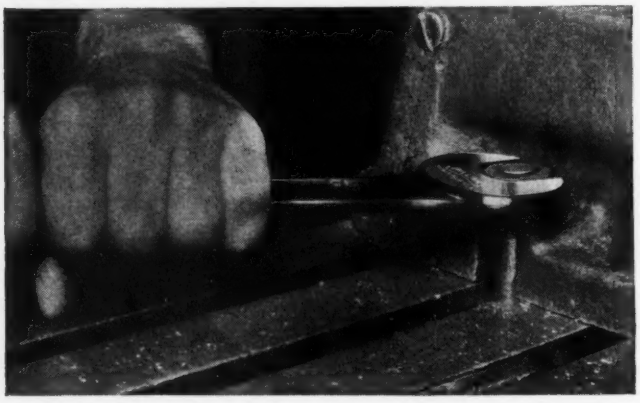
PIONEERS OF *Water Soluble Cutting and Drawing Lubricants*

1736 CARLTON STREET · PHILADELPHIA 3, PA.

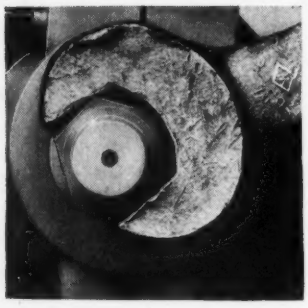
THE HOW AND WHY OF WILLIAMS DROP-FORGED TOOLS

THE PROPER USE OF OPEN-END WRENCHES . . . Data Sheet No. 22

First, select a wrench with the correct size opening for the nut or bolt to be accommodated. Test this by the amount of free back and forth movement of the wrench on a stationary nut. Too large an opening may slip under a hard pull and injure you, the nut, or the wrench.

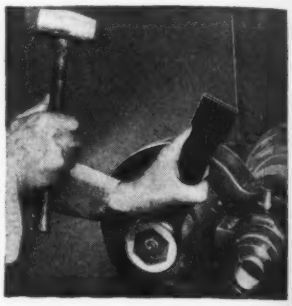


Any wrench will perform best and with highest strength when squarely and fully seated on the nut or bolt head as shown above. Pull straight, avoiding side strain or "cramping" of the wrench. Nine times out of ten you will find it safer to *pull* rather than *push* on a wrench. Greasy hands . . . or greasy wrenches . . . are dangerous. A dry, clean grip always permits the hardest, safest pull and helps to reduce accidents.



Never use a wrench with a badly worn or chewed and spread opening as pictured above—particularly on hex nuts. Williams' Wrenches are stamped with the nominal size of their openings; that is, the size of the nut or bolt head across the hex or square flats. Openings are made .005" to .040" (proportionate to size) larger than the nut or bolt head they are intended to fit. It is, therefore, easy to detect spread openings.

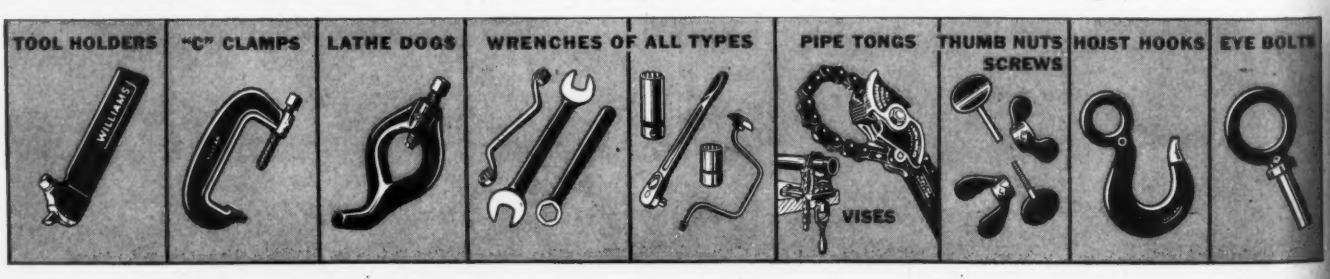
Standard commercial wrench leverages are such that an average man can readily break bolts or strip threads up to 5/8" bolt diameter. Consequently care should be exercised and a sense of "feel" developed. Bolts larger than 5/8" seldom can be set up too tight with average wrench leverages. If you must use auxiliary leverage on large bolt sizes, such as a pipe extension over the handle, make sure the two are strongly and well coupled. The best and safest procedure is to purchase special wrenches with extra long handles.



Never hammer an ordinary wrench handle as a substitute for increased leverage. *Striking-face* wrenches, (see above illustration) made specially for this purpose, should be used. A vast amount of energy is stored in several sharp hammer blows, and ordinary wrenches are not designed to withstand this abuse.

When the usual open-end wrench is operated in close quarters on hard-to-get-at nuts, it should be remembered that "flopping" the wrench upside down between swings gives an angular advantage which permits continuously rotating the nut, or bolt in the least possible space. By this "flopping" trick, illustrated above, the usual 15° angle wrench will operate a hexagon continuously where the swing is limited to 30°; otherwise 60° would be necessary.

Sold by Leading Industrial Distributors Everywhere . . . J. H. Williams & Co., Buffalo 7, N. Y.

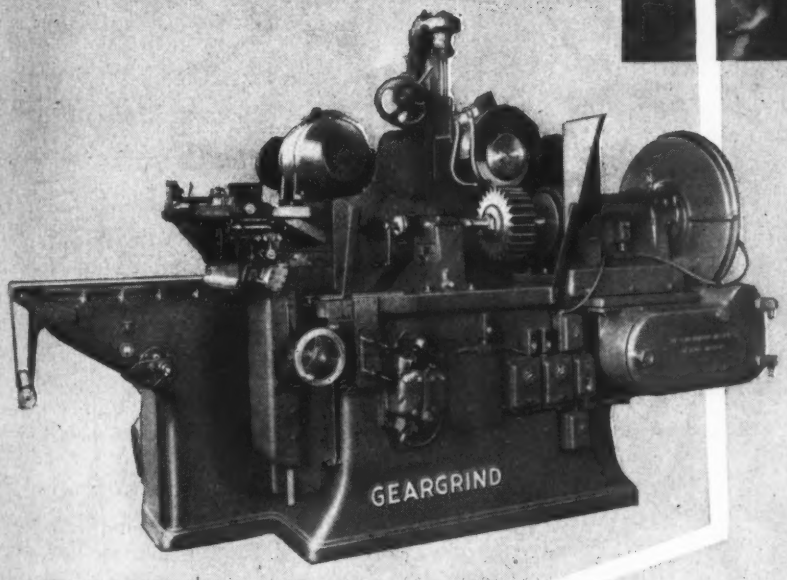


FORMED WHEEL GRINDING

for Better

GEARS · RACKS AND SPLINES

COURTESY LODGE & SHIPLEY MACHINE TOOL CO.



TYPE GG-23-C
24" External Diameter
Gear Grinding Machine

GEARGRIND Machines are responsible for outstanding production records—turning out gears, splines and racks in which required tolerances are easily met, at a speed that insures uninterrupted schedules. There are GEARGRIND Machines that grind gears up to 72" in diameter, and splined shafts and pinions up to 80" in length.

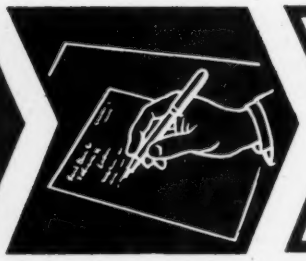
In addition to continuous production, however, GEARGRIND Machines and Formed Wheel Grinding are ideal for producing master gears, spline gauges, spline work arbors, plug gauges, punches and dies, cluster gears and gears of cramped design, as well as general tool room work.

Our general catalog describes the complete line of GEARGRIND Machines for the Formed Wheel Grinding of external and internal gears, external and internal involute splines, straight splines, serrations and racks, as well as special machines for special jobs—worm grinders, slot grinders, and groove drilling machines.

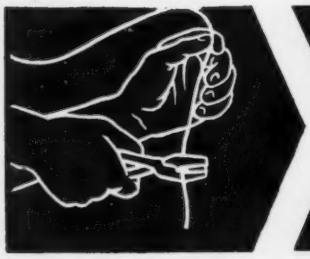
The MACHINE COMPANY

You Save[1] and Save[2] and Save[3] a

1 SAVE ORDERING TIME



Instead of buying two separately mounted devices—a motor-circuit switch and a magnetic starter—you buy one factory-co-ordinated unit that controls and protects your motor. Simply specify the motor rating and indicate the type of motor-circuit switch you want—and we'll send you the control you need.



2 SAVE INSTALLATION TIME

Users report a 50 per-cent reduction in mounting time, 40 per-cent reduction in wiring time, as compared with the installation of two separate devices. You mount one device—not two. You connect only nine terminals—not fifteen. You get your motors into operation quicker.

3 SAVE MAN POWER

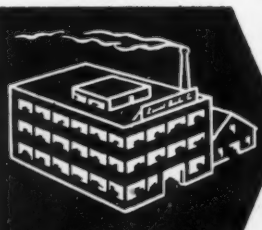
By eliminating one complete mounting job on every installation, you save valuable man power. And because the cover cannot be opened while there is power on the starter, your men have more protection against accidental injury.

4 SAVE CRITICAL MATERIALS

By buying both the motor-circuit switch and the magnetic starter as one compact unit, you save copper wire, steel conduit, and fittings that are necessary for installing two separately mounted devices—plus the saving gained by using only one steel enclosure instead of two.

5 SAVE MONEY

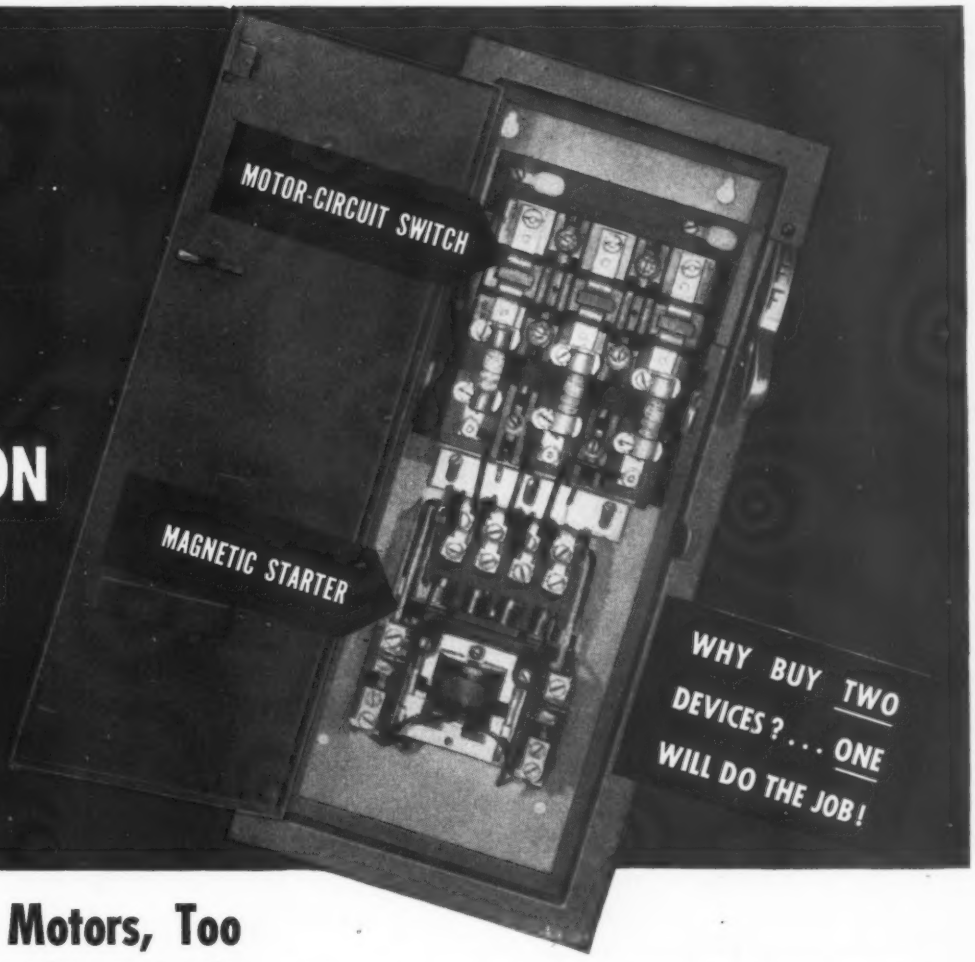
Combination starters cost slightly more than two separately mounted devices, but this difference is more than made up by the savings in wire, conduit, fittings, and installation-labor costs. This statement is based on the actual experience of users.



6 SAVE PLANT SPACE

Combination starters take up less mounting space than separately mounted safety switches and starters. Because of this you can mount them in small, unused places near the operators.

and Save[4] and Save[5] and Save[6]---



GE

COMBINATION STARTERS

---and Save Your Motors, Too

With G-E combination starters, you're sure that the motor-circuit switch or breaker has the proper rating and interrupting capacity for the magnetic starter with which it is used. The fuses or breaker are coordinated with the thermal overload relays to give complete motor protection under short-circuit or overload conditions.

It's the simple, logical way to get control and protection for your motors—in one compact, easy-to-install unit. Why buy two devices, when this one will do the job?

NAME YOUR HAZARD

G-E combinations come in enclosures to meet any operating condition: dust-tight, watertight, oil-immersed, general-purpose, or for hazardous locations. Available for motors from 1 to 1000 horsepower.

GENERAL GE ELECTRIC

Next time you order motor control, save seven ways by specifying General Electric combination starters.
General Electric Company, Schenectady, N. Y.

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

General Electric Company, Section J676–129
Schenectady, N. Y.

Please send me the bulletins checked below:

- GEA-3715—Combination starters: general-purpose, watertight, and dust-tight
- GEA-3660–2300-volt combination starters
- GEA-3804—Combination starters for hazardous locations
- GEA-3541—Oil-immersed starters

Name.....

Company.....

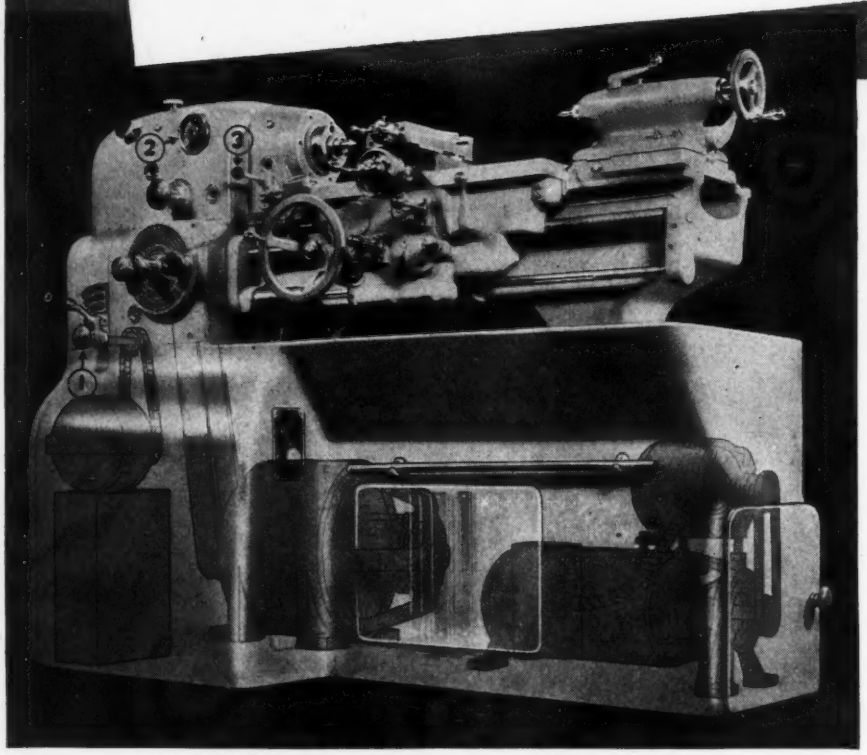
Address.....

City.....State.....

3928

Now you can have your machine tools designed the way you've always wanted them!

RELIANCE V★S DRIVE



Precision Lathe with Built-In Reliance V★S Drive

A BUILT-IN ALL-ELECTRIC DRIVE FOR A-C CIRCUITS

eliminates gears, brakes and clutches

FOR EXAMPLE, the designers of this all-electric precision lathe made full use of the Reliance V★S Drive. They offer:

> A lathe giving spindle speeds from 5 to 2500 rpm. with but one gear change . . . All electrical equipment is built-in and arranged for connection to an a-c. circuit . . . Speed changes at the turn of a handle (1) . . . Spindle speeds indicated by tachometer (2) . . . Spindle operation (starting, stopping, reversing), all controlled through the motor by a small switch on the headstock (3).

The Reliance V★S Drive is more than a source of power. In machine tools, it provides speed control for spindle or table and for feed drives. It replaces change gears, reversing gears, brakes and clutches—not only in machine tools, but in many other motor-drive applications.

You, too, may find in Reliance V★S Drive the *new* design opportunities you have been looking for. Call in a Reliance Application Engineer or write for Bulletin 311.

RELIANCE A-C D-C MOTORS

RELIANCE ELECTRIC & ENGINEERING COMPANY

1088 Ivanhoe Road • Cleveland, Ohio

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE (S. C.) • LOS ANGELES • NEW YORK • PITTSBURGH
PHILADELPHIA • PORTLAND (ORE.) • ST. LOUIS • SALT LAKE CITY • SAN FRANCISCO • SYRACUSE AND OTHER PRINCIPAL CITIES

Cutting oil *News* letter

Practical suggestions from the field on how cutting oils and coolants are being used by midwest machine operators to lick tough wartime jobs.

FEBRUARY, 1944

Find thread chasers an awful grind? Try Stanicut. Dies for threading aluminum parts taxed the tool department in an Illinois war plant. In cutting a 1⅛"–16 external thread, chasers had to be ground every three days. Then Stanicut 137BCS was put on the threading operation. Dies lasted 25 days before they needed regrinding. Less grinding meant less tool stock wasted, less tool maker's time needed, and more parts produced.

Outboard motor used as an agitator in big soluble oil tank

Big saving for big soluble oil user. Soluble oil is used in large quantities by a manufacturer turning out 105 mm. shells. The central mixing tank which feeds the machine is so large it is agitated by an outboard motor. When this war job was started no expense was spared to avoid trouble. A rich solution of an expensive oil was used. Later, tests of other oils were made. Superla Soluble Oil was one of these. With it, mixes as high as 25 to 1 are doing finished work satisfactorily. These lean mixes of Superla have cut soluble oil costs to ⅓—a 4-figure saving yearly at this plant.

Cutting oil in place of kerosene doubles tool life. Machining bronze on a turret lathe wasn't a particularly difficult job at one Indianapolis plant. Kerosene was used as a coolant. Its viscosity was low, it did not stain the work, and it was easy to get. But tool life wasn't exactly good. One of the new Stanicut oils, developed to meet the increase in machining of non-ferrous metals in war plants, was tested. It, too, had the right viscosity and cooling qualities, did not stain the work, and was readily available. But it also doubled tool life. Take advantage of new cutting fluid developments by talking over your machining, grinding, and stamping problems with a Standard Cutting Oil Specialist.

Cutting oil or soluble oil? When in doubt try Stanicool H. D. Many factors enter into the question of which coolant to use, cutting oil or soluble oil. Sometimes neither does the *whole* job. With a soluble oil, even in concentrated mixes, tool life may be poor. With cutting oils, cooling may be inadequate, resulting in poor finish and burned tools.

Stanicool H. D., a heavy-duty soluble oil, has been the answer in many plants. The job of boring, turning, and facing forged gear blanks was one example at a central Illinois plant. Excessive smoking and overheating occurred when a cutting oil was used. A conventional soluble oil gave poor tool life. Stanicool H. D. mixed 7 to 1 eliminated the smoking. Gear blanks came off of the machine considerably cooler. Stanicool H. D. gave satisfactory tool life plus an extra dividend in lower oil costs.

What are YOUR problems?

The few examples cited here are typical of jobs Standard Cutting Oil Engineers are doing daily for operators who have asked for help. Take the time to explain your problems to one of these Engineers. He may have a number of suggestions that will help you save much needed manpower, materials, and tools. Call any Standard Oil Company (Indiana) office, or write 910 South Michigan Ave., Chicago 5, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

• LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICAT

Lubrication *News* letter

Practical suggestions from the field on how Lubrication Engineering and lubricants are being used by midwest operators to lick tough wartime jobs.

FEBRUARY, 1944

Compressor fire hazard reduced. Excess oil in the receiver of multi-stage compressors is never desirable—it can be dangerous. When heavy loads, long hours of operation, or faulty cooling units allow operating temperatures to rise it presents a definite fire hazard.

A Michigan war plant found it out the hard way—by experience. After one or two "experiences" which left no doubt that something had to be done, a Standard Lubrication Engineer was called in. He made three suggestions:

1. Lower intake air temperatures.

2. Lower cooling water temperatures in the after-coolers. This not only cools the air, but also condenses oil vapor before it is carried over into the receiver.

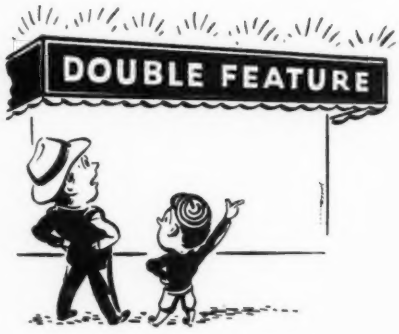
3. Lastly, but of first importance, use a better oil so that less is needed to secure adequate lubrication.

In this case Stanoil 31 was the answer. After three months' use there has been no recurrence of receiver fires, and oil consumption has been reduced 50% with adequate lubrication of the compressors.

P. S. to the above. As an added attraction, Stanoil and the Lubrication Engineer also cured a long standing problem on this Michigan plant compressor. Windings on the compressor motor were oil soaked. The Engineer pointed out that Stanoil's high V. I. (viscosity index)—a quality which prevents it from thinning out excessively when temperatures go up—would keep the oil *in* the motor bearings and *off* the windings. It did just that. The saving in maintenance this made was almost as important as the 50% saving in oil consumption mentioned above.

Two reasons why some Hydraulic Oils go bad—and Stanoil doesn't

Viscosity increase and acidity are two signs of deterioration in hydraulic oils. Either may make hydraulic oils unfit for further use.



An excessive increase in viscosity makes operation sluggish in most hydraulic systems. High oil acidity causes deposits, oil discoloration, and poor separation from water which may result in foaming and erratic operation if there is moisture in the system.

Stanoil is made to reduce both of these troublesome causes of hydraulic oil failure, not just in laboratory tests but in actual service. For example, a Lansing, Michigan plant uses a large quantity of hydraulic oil. Because of this an accurate check is maintained on oil condition. Records from this plant show a typical sample of Stanoil No. 18 after 2392 hours of almost continuous operation to have the same viscosity as unused oil, and a neutralization number of only 0.15. Stanoil has operated in this plant for periods as long as 7200 hours with no appreciable change in viscosity or acidity, and it has not been necessary to change oil in some units in over a year.

If you are obliged to change hydraulic oil frequently or have deposit trouble, erratic operation, or persistent foaming, let a Standard Lubrication Engineer analyze your problem. A change in the hydraulic system or a change to Stanoil, or both, may save labor, down time, and oil.

What are YOUR problems in maintenance and lubrication?

The few examples cited here are typical of jobs Standard Lubrication Engineers are doing daily for operators who have asked for help. Take the time to explain your problems to one of these Engineers. He may have a number of suggestions that will help you save much needed manpower, material, and scarce equipment. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 5, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Can't throw Stanodrip. Lubrication of stitching machines making wire bound boxes is a tough job. Action of many parts on the machine is very rapid and jerky. Ordinary lubricants tend to fly off in all directions. Oil on the box wood spoils the work. Oil on operators means less oil stays in the machines.

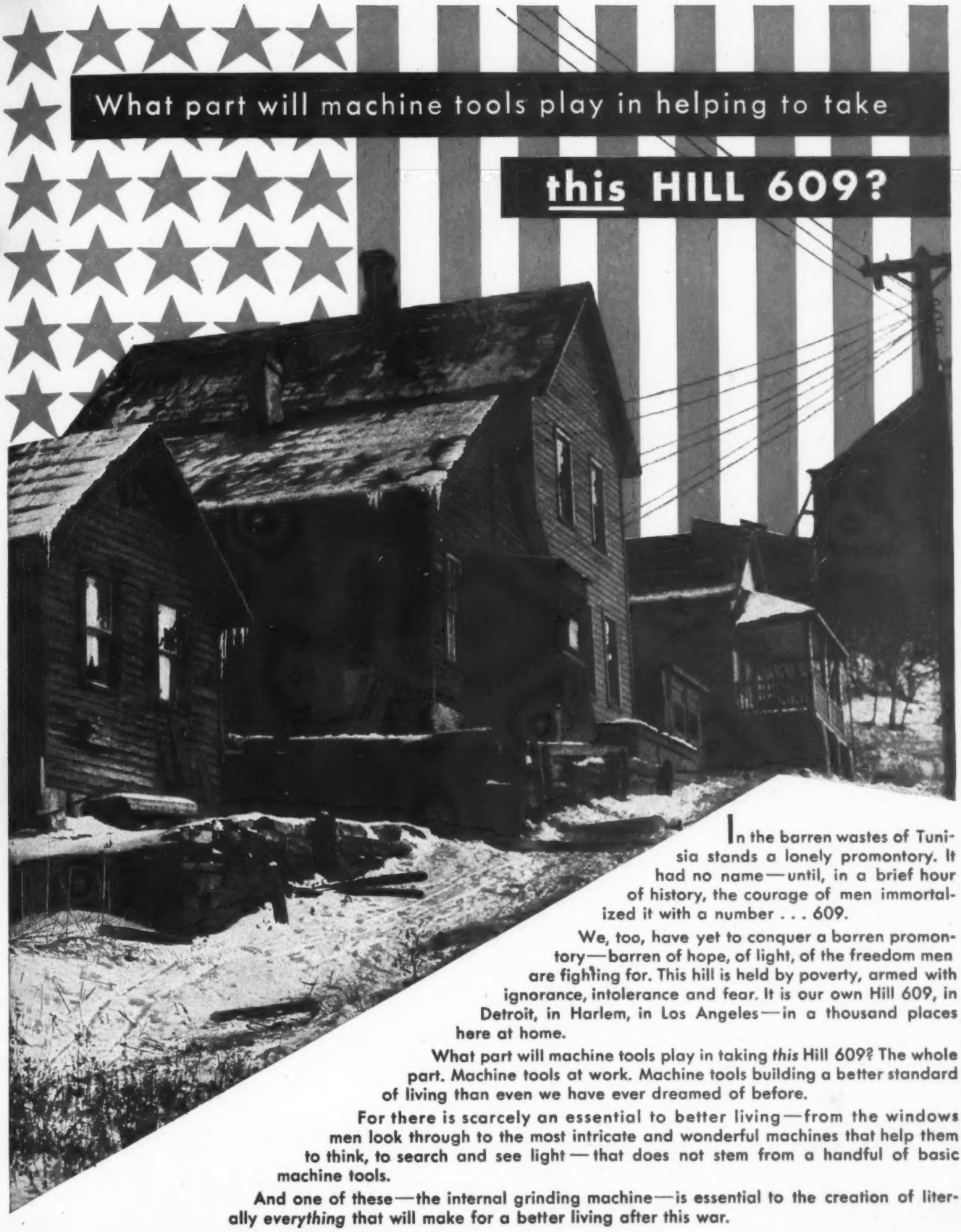
Machine operators were the first to cheer for Stanodrip when it was tested. They got less spoilage, less trouble from machines because of too little lubricant, and spent less time putting oil on the machine and taking it off of themselves. Stanodrip is on this job to stick.

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

G•••LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICA

What part will machine tools play in helping to take this HILL 609?



In the barren wastes of Tunisia stands a lonely promontory. It had no name—until, in a brief hour of history, the courage of men immortalized it with a number . . . 609.

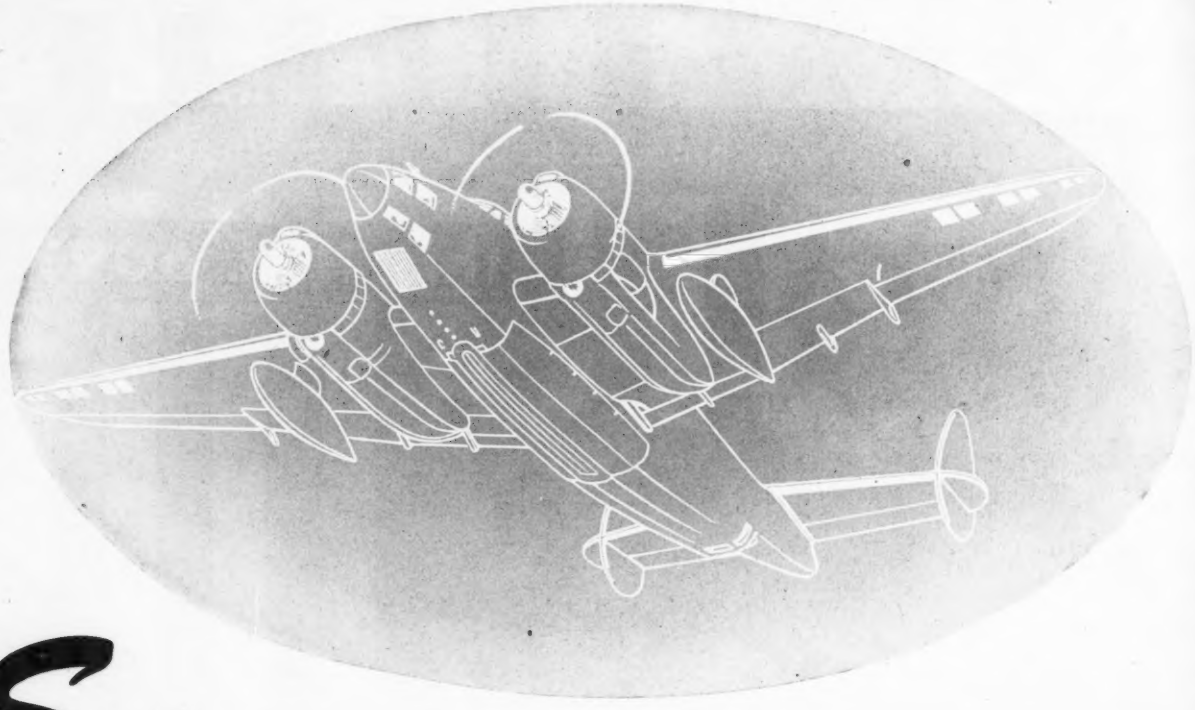
We, too, have yet to conquer a barren promontory—barren of hope, of light, of the freedom men are fighting for. This hill is held by poverty, armed with ignorance, intolerance and fear. It is our own Hill 609, in Detroit, in Harlem, in Los Angeles—in a thousand places here at home.

What part will machine tools play in taking *this* Hill 609? The whole part. Machine tools at work. Machine tools building a better standard of living than even we have ever dreamed of before.

For there is scarcely an essential to better living—from the windows men look through to the most intricate and wonderful machines that help them to think, to search and see light—that does not stem from a handful of basic machine tools.

And one of these—the internal grinding machine—is essential to the creation of literally *everything* that will make for a better living after this war.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

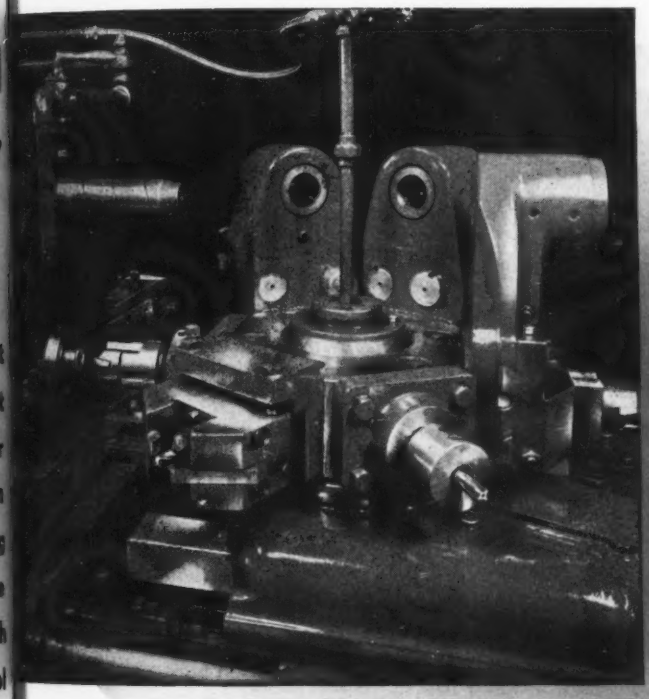


Solving VEXING PRODUCTION PROBLEMS . . *successfully!*

Aircraft production engineers find it advantageous to specify the extensive use of P&J Automatics for solving successfully many intricate and vexing machining problems—and consequently apply these versatile machine tools to the high speed production of various essential parts for Aircraft Engines. One of the most popular of P&J Automatics for efficient wartime output is the 4-D Machine, illustrated at the right as it was set up for operations on Aircraft Reduction Gear Pinions. A deep trepanning cut is required, undercut at the bottom. The upper photograph shows the tooling . . the slide tool on the fifth turret face is presented to the work, the tool and turret

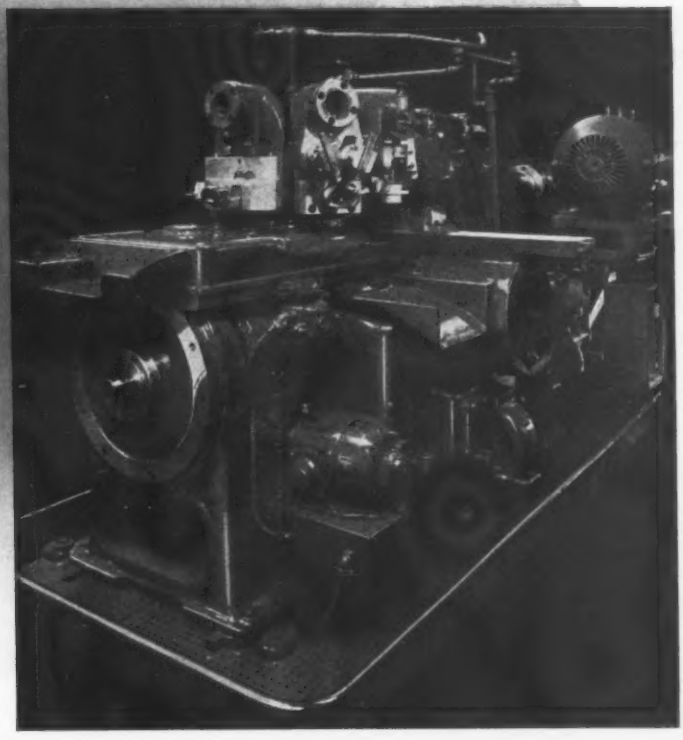
POTTER and JOHNSTON

slide being supported by the overhead pilot bar. As the turret slide advances to the dwell of the operating cam, the cutting tool in the boring bar, having reached full depth, is fed over by action of the cross slide against the slide tool on which the boring bar is mounted. Altogether approximately thirty operations are performed on this set-up alone, not counting finishing operations. Final finishes obtained on these Machines are well within the most rigid aircraft standards. A battery of these machines is easily handled by one operator, an indication of the man-power economies of P&J Automatics.



POTTER & JOHNSTON MACHINE CO.

PAWTUCKET ★ RHODE ISLAND



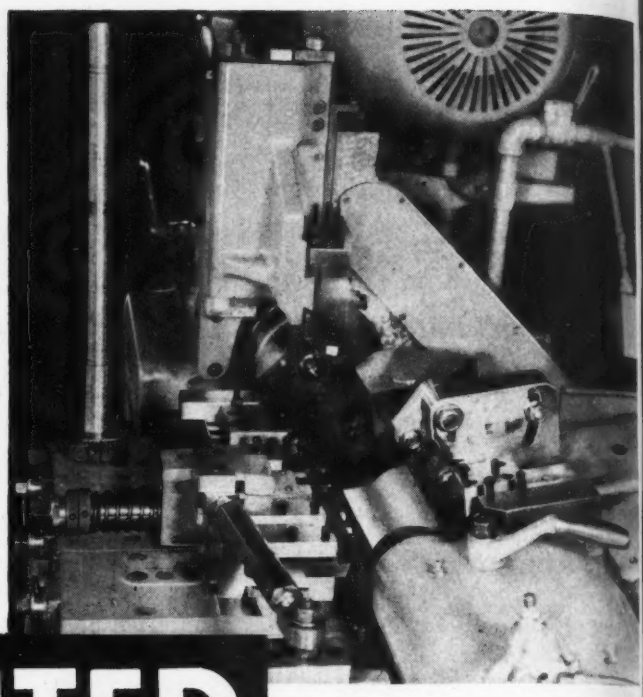
Better Buy Bonds!

AUTOMATICS

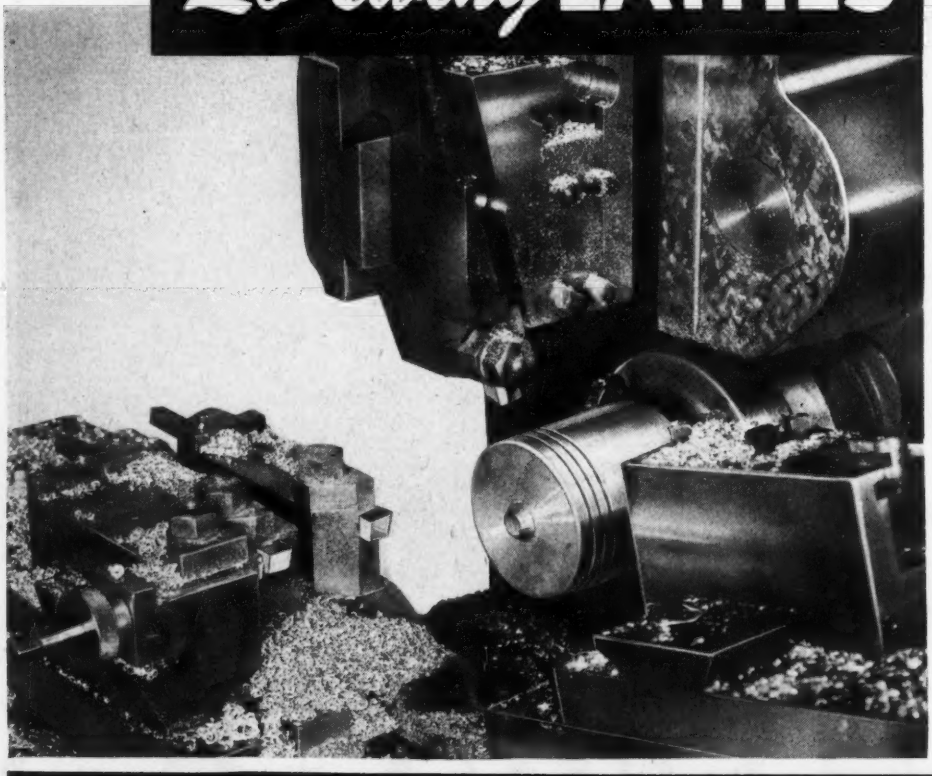
MODEL "LR" *Lo-swing*

Illustration at right shows tooling of a Model "LR" equipped for turning an Automobile Transmission Shaft. Equipment furnished consists of one three-slide Front Carriage; two Back Attachments, one carrying tools, the other a two-roll steady rest; one Top Slide; one 45° Undercutting Attachment.

The automatic cycle is as follows: First, the tools on the center slide of the Front Carriage spot the shaft for a Steady Rest bearing; Second, Steady Rest on Back Attachment moves in automatically to support work; Third, all tools start cutting simultaneously, those on Front Carriage turning all diameters, tools on Top Slide face and groove, tools on Back Attachment chamfer and groove while the Undercutting Attachment tool undercuts the head end at a 45° angle. The operation is entirely automatic. Operator merely loads and unloads and pushes starting lever.



UNLIMITED
TOOLING POSSIBILITIES
ARE AVAILABLE WITH THE LATEST TYPES OF AUTOMATIC *Lo-swing* LATHES



Lo-swing IMP

At left is a close-up illustration of an Imp Lathe equipped for turning, facing and rough and finish grooving aluminum pistons on a production basis.

The work is held and driven by an air-operated Wrist Pin Type Driver. The three tools mounted on the front carriage turn the skirt, ring groove lands, and round the end of the piston, while simultaneously the tools on the top slide face the end and rough turn the grooves. Immediately these tools have ceased cutting, the finish grooving tools on the rear slide finish the grooves to close tolerances.

The cycle is automatic . . . the operator simply loads and unloads the pistons and pushes the starting lever.

SENECA FALLS MACHINE CO.
SENECA FALLS, NEW YORK

LATHE NEWS *from* SENECA FALLS

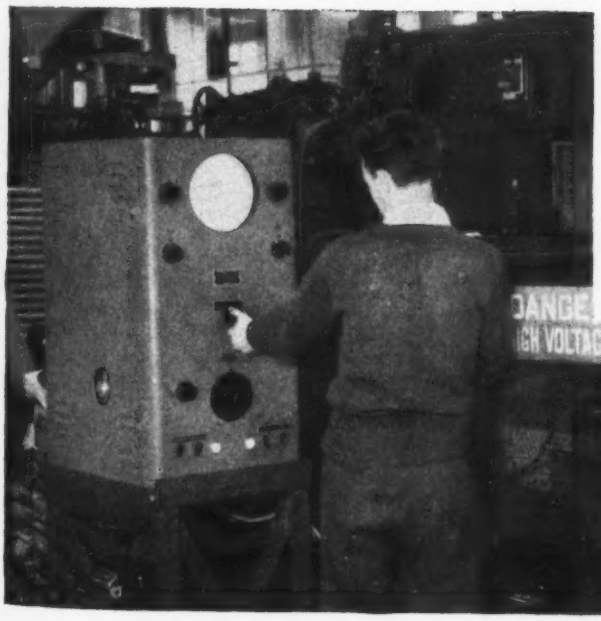
SHORTS STYMIED

Voltage surges which accompany switching and frequent starting and stopping of motors impose high dielectric stresses on the coil insulation, and can cause harmful short circuits. Yet this is an unavoidable condition of service for many motors.

The grinder shown here, for example, starts and stops every time a finished part is removed and a new part inserted. But the two Tri-Clad motors that drive it have been built to withstand safely the voltage surges ordinarily encountered in this type of service. Their ability to "stymie" shorts was proved by *the new General Electric test* described below.

External grinder, equipped with two Tri-Clad motors, installed in the milk-machinery manufacturing plant of the Rite-Way Products Company, Chicago, Ill.

New high-potential, electronic surge-tester verifies strength of TRI/CLAD motor windings



This electronic test of insulation makes a "cardiogram" of every Tri-Clad motor winding, ferreting out weaknesses that might lead to shorts caused by voltage surges in service. It tests each turn, coil, and phase group of the windings for adequate insulation strength to withstand the "steep front" high-voltage surges of actual service. First developed and applied by G.E., it's one of the production tests which all Tri-Clad motors must pass as they come off our production lines. – *General Electric Company, Schenectady, N. Y.*

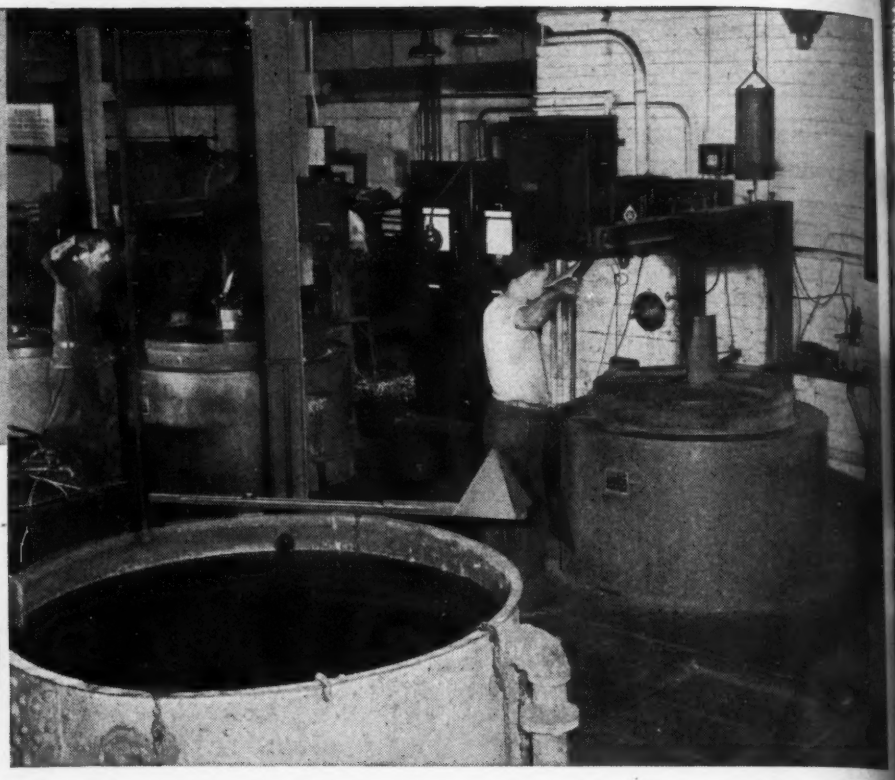
GENERAL ELECTRIC

Each week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

TRI/CLAD MOTORS

A Yale Padlock's shackle, actual size.

Cross Section, enlarged to show skin-deep hardening.



Two of Yale & Towne Mfg. Co.'s Homocarb Furnaces, used in the Stamford, Conn., plant for shallow-case gas-cyaniding of lock shackles as well as for straight Homo Carburizing.

How Yale & Towne Harden Shackles *Skin Deep*

The problem in hardening the above-shown shackle for a Yale padlock is to give its tough but soft steel a file-hard non-brittle skin. This skin or case must be only 0.008″ to 0.012″ thick, depending on size; it must be within a fraction of a thousandth of the specified thinness; and it must be extremely uniform.

These "musts" have long been met by the use of one of the old-established case-hardening methods. But, when "Homo-cyaniding" became available a few years ago, Yale & Towne executives decided to review the situation. They investigated; tried the Homo-cyanide method thoroughly, and have now adopted it because it gives great uniformity and is clean, quick and automatically controlled. The operation is as follows:

Twenty-five hundred shackles (260 lbs) are divided between three alloy trays, which are then nested in the Homocarb Furnace.

Forced-convection heating by the genuine Homo Method brings the load rapidly and uniformly up to the gas-cyaniding temperature of 1550F.

After loading the furnace the heat-treater starts an automatic injector which feeds Homocarb Fluid into the furnace. This fluid "cracks" to form Homocarb gas; both prevents scale and carburizes. Then, at the proper point in the cycle, a small, steady flow of ammonia is admitted.

The ammonia and Homocarb gas, mixed and distributed through the load, reacts with the steel to form the intensely hard case required. Because the Homo Method distributes the mixture so thoroughly, the case is highly uniform; and because the Micromax Temperature Control holds the heat so constant, the thickness of the case is regulated with great exactness by simply soaking for the desired time.

The heat-treater therefore has only to watch the time, and quench promptly in brine, to get the correct structure. There are practically no rejects of these urgently war-needed parts.

Quenching shackles in brine. The pyramidal spreader, on end of steel rod, scatters shackles so that each is quickly and thoroughly quenched to make its Homo-cyanided surface file-hard.

If you have a gas-cyaniding problem, outline it and an L&N engineer will either call or send Catalog T-623, as you prefer.

Jrl Ad T-623(17)

depends on me!

A Slogan For Every American

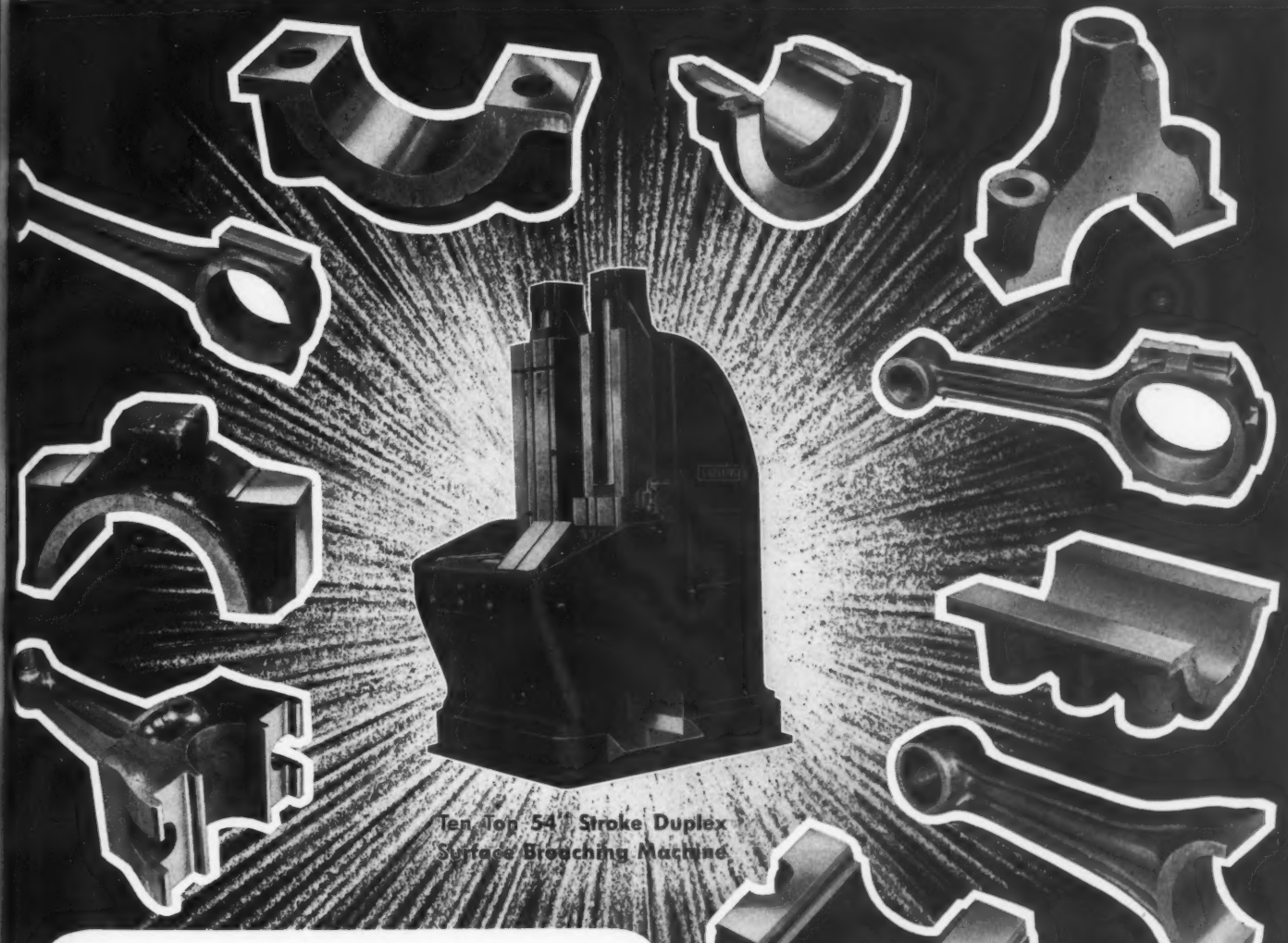
LEEDS & NORTHRUP COMPANY, 4921 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Surface Broaching

for Connecting Rods and Caps, and Main Bearing Caps



Ten Ton 54" Stroke Duplex Surface Broaching Machine

★ Just one of the fields in which Footburt Surface Broaching is saving production time is the machining of various types of automotive and aircraft motor connecting rods and caps and main bearing caps. Half round sections, contact faces, bolt bosses, sides and ends are all surface broached with exceptional speed and accuracy. It will pay you to investigate this method of saving time and money on today's production problems and for tomorrow's competitive markets.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

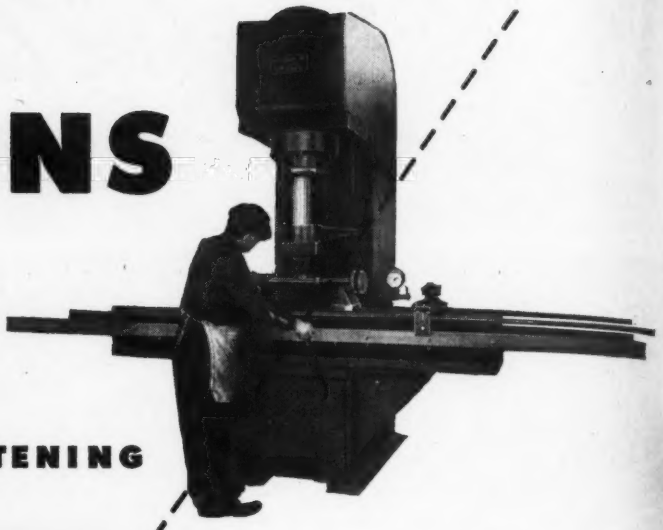
FOOTBURT *Surface* BROACHING

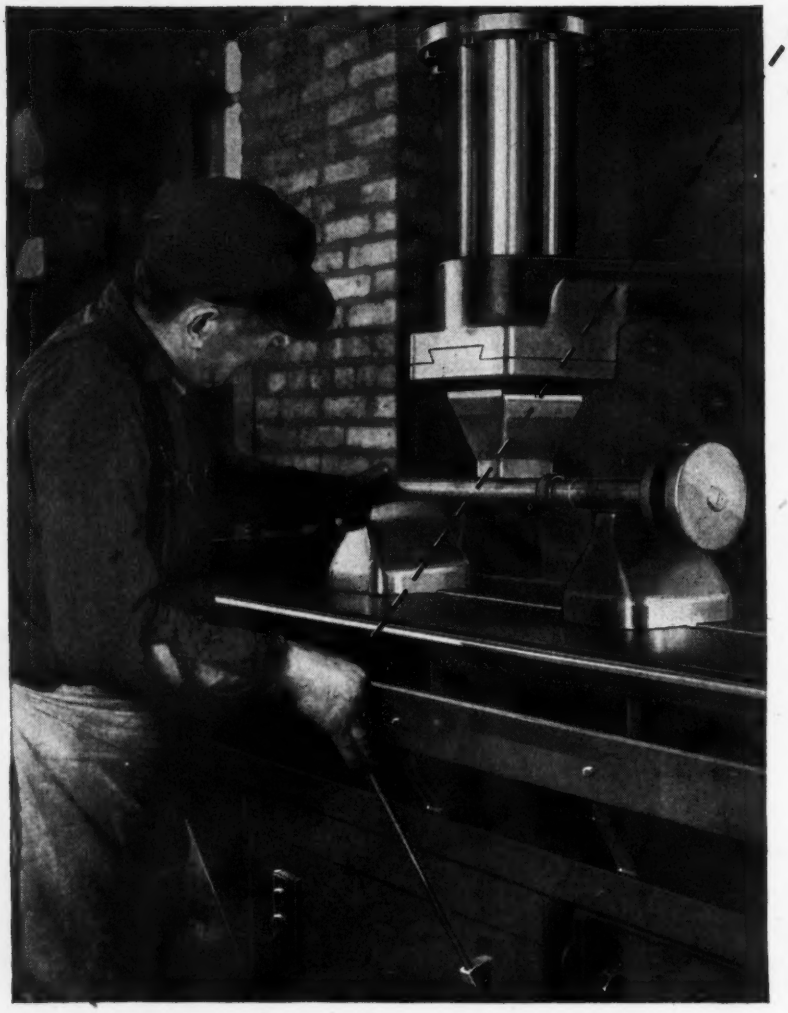
MOVE UP THE SCHEDULE ☆ WIN THE WAR QUICKER

100 TONS

AT A FINGER-TIP TOUCH

FOR FAST, ACCURATE STRAIGHTENING





100 ton capacity Hannifin hydraulic press with long table and roller-vee type fixture, being used for straightening forgings at a plant of the Kropp Forge Aviation Company.

Hannifin sensitive pressure control speeds precision straightening operations on a variety of forging work at this Kropp Forge Aviation Company plant. Infinitely variable, proportional ram pressure, from a few pounds up to full capacity of 100 tons is right under the operator's hand. Moving the control lever down increases ram pressure; releasing the lever returns the ram to top position. Operation of this straightening press is so simple, so natural, that the operator's attention and skill can be devoted to the work without thought about control.

Even on small work, like that shown here, sensitive pressure control makes this 100 ton press as easy to handle as a press of much smaller capacity, allowing it to be used efficiently for a great variety of work.

This is but one example of the many Hannifin hydraulic presses being used in modern manufacturing operations by producers of aircraft, machine tools, military vehicles, and armament.

Hannifin hydraulic presses are built in a wide range of standard types, capacities 5 tons to 200 tons, for straightening, forming, press assembly, and similar operations involving the application of pressure. Write for press bulletins or consult Hannifin engineers for recommendations.

HANNIFIN MANUFACTURING COMPANY
621-631 SOUTH KOLMAR AVENUE, CHICAGO 24, ILLINOIS

Write for bulletins giving complete specifications of Hannifin products: Hydraulic Presses, Bulletin 60; Pneumatic Cylinders and Air Control Valves, Bulletin 57; Hydraulic Cylinders, Bulletin 35; Pneumatic Arbor Presses, Bulletin 46; Quenching Press, Bulletin 55; "Allen" Pneumatic Riveters, Bulletin 43; "Hy-Power" Hydraulic Riveters, Bulletin 53; Air Pressure Regulating Valves, Bulletin 58; Pneumatic Vises, Bulletin 59.

HANNIFIN *Hydraulic Presses*

What will your future I.P. be?
†† This is the Second of a series of advertisements presenting "Industrial Par" and its importance to your company in all future planning. Save this and succeeding I.P. advertisements as the basis for discussion and as a guide to your planning program.
2% INVESTED IN MACHINE TOOLS *
9 BILLIONS OF $
(VALUE OF PRODUCTS

So much from so little

The Annual National Investment* in machine tools represents only 2% of the total value of products produced by machine-tool-using industries.

YES — in the ten peace years 1927 to 1937 — the builders of machine tools produced a yearly average of 122 million dollars worth of equipment for American industry. The industries that bought and used these machine tools were able to produce an average of about 9 billion dollars worth of peacetime products annually in those same years. The annual investment in machine tools represented only about 2% of the total value of products created by these machine-tool-using industries — the makers of engines and turbines, agricultural and construction machinery, automobiles, planes, locomotives, household appliances and many other useful things.

In terms of productive power this is impressive — certainly "very much from very little." But what significance have these rather startling ratio "figures" to industrial management? Industrial statistics show that the national output per man-hour tends to increase constantly — its previous rate of 2½% per year compounded can be expected to advance to 4% or 50% increased output per man-hour every 10 years.

Manufacturers who intend to keep step with a high level of national prosperity — the volume production which means more goods for more people at lowest cost and security of jobs and wages for the greatest number of workers — must strive to attain the 50% increased output pace. Certainly full advantage must be taken of the inherent ability of machine tools to achieve the most with available man-hours, for only with the most modern machine tools can any manufacturer hope to compete successfully over a period of years as well as make workers' jobs safer, easier, and more productive.

Isn't it only logical to equip your plant with machine tools — those possessing the greatest sustained productive power, the ability to produce fast, accurately at lowest cost — the better to win your race with competitors in the world of peace production to come?

Back the attack **BUY MORE BONDS**

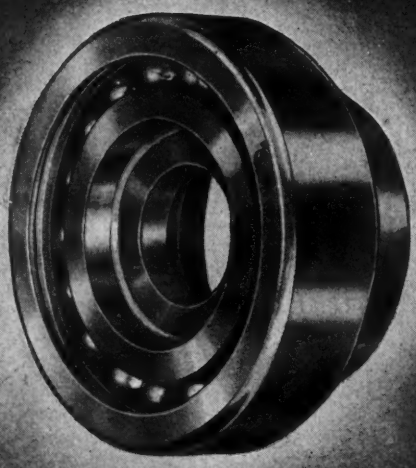
Spotlight facts for your future I.P. *planning*

* Production methods — developed in wartime — increase man-hour output; pent-up buying power — released in peacetime — demands increased production.
* The rate of 2½% increase per year output per man-hour, established by a 12 year record of industrial production, can be expected to reach at least 4% per year — compounded.
* Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.
* Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. *Such replacements yearly should be equal to 10% of the total machine tool investment — in keeping with increased output.*
* The cost of machine tools is insignificant in terms of their productive power . . . from 1927 to 1937, according to census reports, American manufacturers had only a total of about 2% invested yearly in machine tools in ratio to a total volume of 9 billion dollars' worth of production annually.

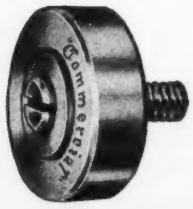
†† **Industrial Par** — *the constantly increasing output per man-hour equal to approximately 50% every 10 years.*

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14 WISCONSIN

Milwaukee Machine Tools

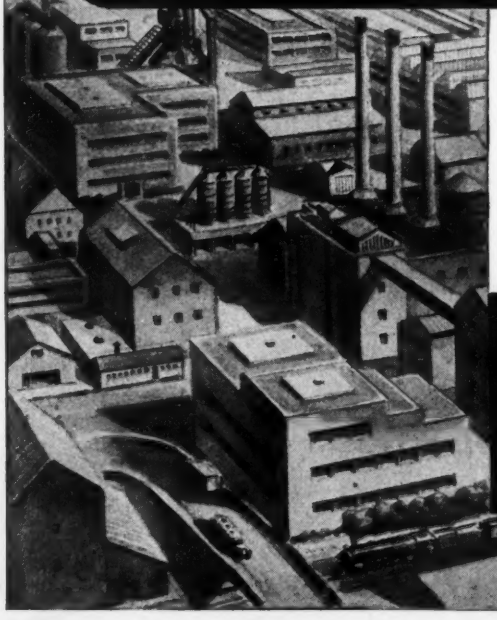


Used in hundreds of different industries and products...



"Commercial"

ANNULAR BALL BEARINGS



FOR THE DURATION, WE ARE UNABLE TO SUPPLY MANY TYPES OF BEARINGS FORMERLY MANUFACTURED

THE SCHATZ MANUFACTURING CO.
U. S. A.
REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower • Chicago: 902 S. Wabash Ave.
Cleveland: 402 Swetland Bldg. • Los Angeles: 5410 Wilshire Blvd.

CINCINNATI HYPRO PLANERS AT WORK FOR VICTORY . . . "Down Under"

Photo—Sydney Morning Herald

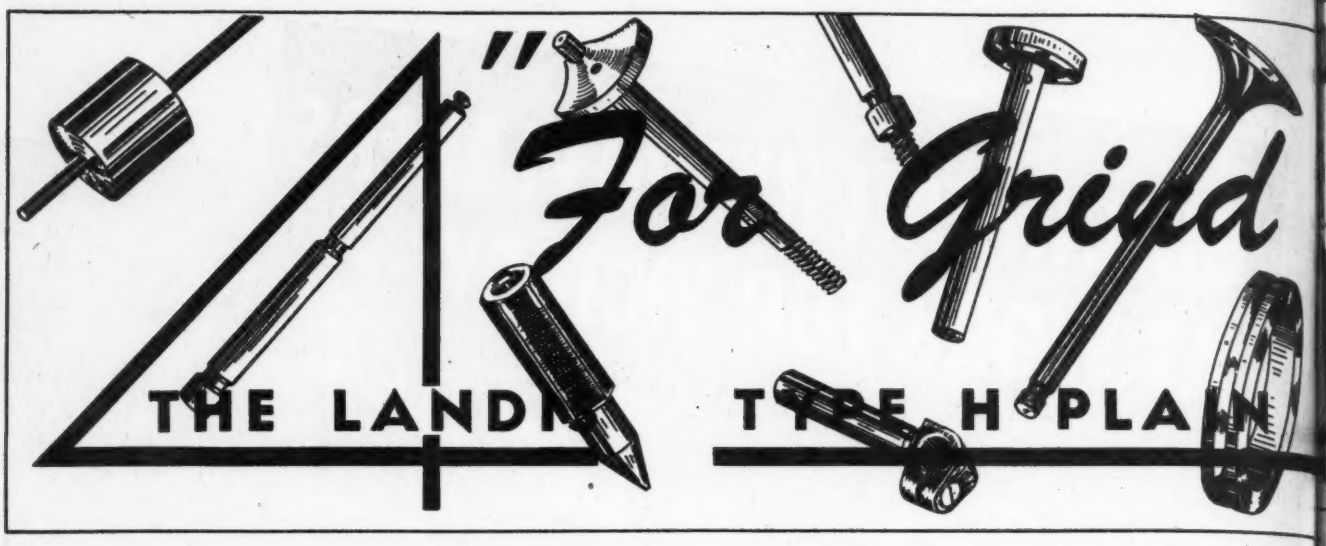
ARMY (E) NAVY

● Many thousands of miles away, in such far-off cities as Adelaide, Sydney and Melbourne, CINCINNATI HYPRO Planers are working 24 hours a day . . . machining metal for Victory! Other CINCINNATI HYPROS are serving in all the British Dominions. Still others are in operation in India. They are backing the Russian attack . . . they are aiding our heroic friends in the Republic of China. Our Allies have discovered what American manufacturers have known for 45 years . . . that CINCINNATI Planers machine parts fast and accurately . . . that they are designed to withstand the heaviest cuts at more than rated motor speed . . . and that the Hypro Herringbone Drive provides unparalleled smoothness of operation.

THE CINCINNATI PLANER COMPANY

Planers...Vertical Boring Mills...Planer Type Millers

CINCINNATI . OHIO . U.S.A.



Want to grind those very small parts just a bit faster than you are right now?

Practically anyone faced with this problem would quickly answer "Yes." Those who do should ask us for more information about the Landis 4" Type H Plain. If you are already using these machines, on the other hand, you are probably getting the maximum production possible on grinding equipment available today.

Many factors contribute to the productiveness of the Landis 4" Type H. Most important is the availability of a combination of cycles which makes it possible to handle work with the minimum number of manual operations. Of almost equal importance is the Microsphere wheel spindle bearing construction. This permits such close clearances that no appreciable time is required for sparking out at the end of the cut. Other factors are the great weight of the machine and its inherently sound over-all design.

Look at the five typical examples of unusual output recorded on these two pages. If you think such results are not possible in your plant, just challenge us to show you that they are.

426

GREAT

1 Chuck manufacturer grinds chuck jaws using a special fixture to hold the work — otherwise standard equipment. Production is 250 per hour within a limit of .0005" and removing .006" stock.

Unusual Performance as Usual

2 Large ball bearing manufacturer grinds small inner ball bearing raceways with a formed wheel and holding the work between centers on an arbor. Production is 130 per hour within limits of .0002" concentricity and .0005" diameter and removing .005" stock. Two arbors are used, the operator unloading and loading one while the other is in the machine.

3 Tap manufacturer performs 4300 operations in 10½ hours on ¼" taps. In this period, 2000 shanks are ground removing .006" stock and 2300 flutes removing .012" stock.

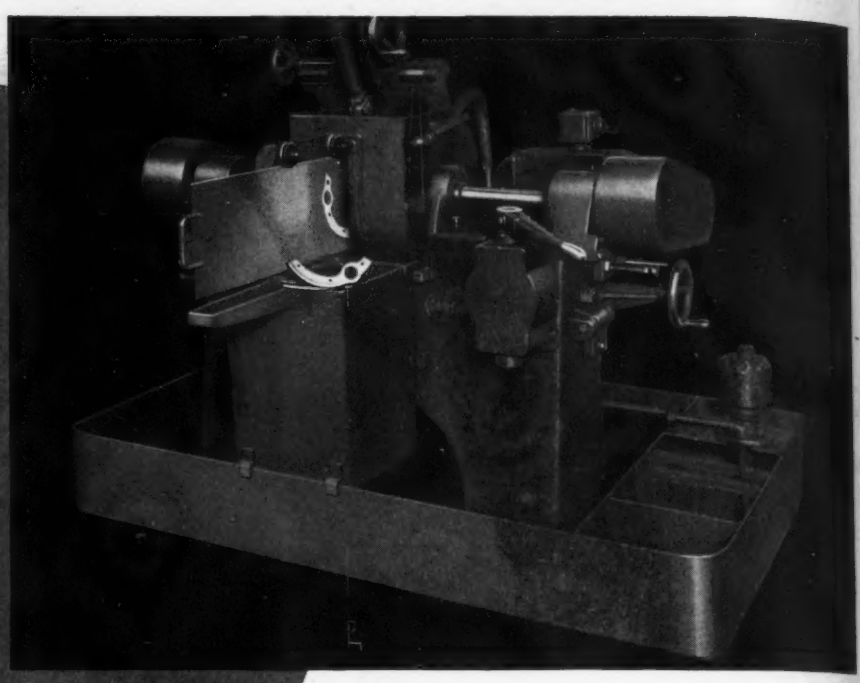
PRODUCTIVENESS

4 Electrical equipment manufacturer grinds three surfaces of a small exceedingly tough stainless steel shaft. These parts are finished from the rough to final size removing .015" to .018" stock. Three separate operations are performed with the rate of production being the same for each operation, that is 1300 in 8 hours. Limits on end diameters are .0003", on middle diameter .0004".

5 Instrument manufacturer grinds gimbal journals within limits of .0003" and removing .008" stock. Each gimbal has a large journal on one end and a small journal on the other. Both are ground as a part of the same operation simply by turning the piece end for end. 180 journals are ground per hour compared with previous production of 50 journals per hour on a hand operated machine. This increase in production is typical of what might be expected when a modern 4" Type H is installed and when the nature of the work being ground is such that a completely automatic grinding cycle may be employed.

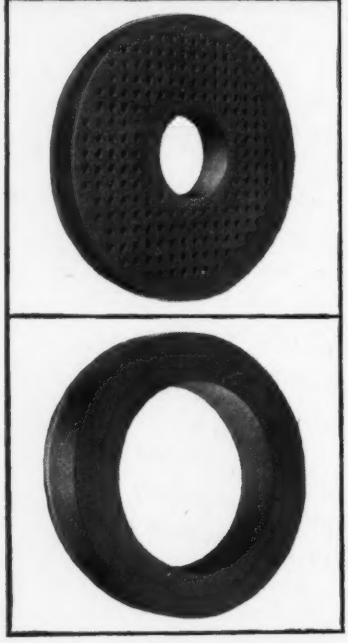
LANDIS TOOL COMPANY
WAYNESBORO—PENNSYLVANIA

Grinds these brass plates at ONE *per minute!*



GARDNER *Double-Grinding* SCORES AGAIN!

WIRE-LOKT ABRASIVES *mean more efficient* DISC GRINDERS



IF YOU finish parallel-surface parts, take a look at what this Gardner Double Grinder is doing.

The pieces seen here, are brass cam retainer plates. They are quite thin (3/16" in thickness), and must be ground within .001" for parallelism.

A Gardner No. 14A-20" machine, carrying a hand-operated roller gun-type sliding fixture, turns out these plates at 50 TO 60 PER HOUR.

Plenty of coolant helps maintain the close accuracy required.

If your own production requirements are greater-than-average, semi-automatic models are available.

GARDNER DOUBLE-GRINDING possesses surprising possibilities - *Investigate them!*
ASK FOR OUR "DOUBLE-GRINDER" BULLETINS.

ARMY E NAVY

GARDNER MACHINE COMPANY
414 East Gardner Street , , , , Beloit, Wisconsin, U.S.A.

Ammunition for today and tomorrow

"Fittings" the trade calls them. But the term tells only half the story—and the least exciting half, at that. For these carefully-made but inconsequential-looking gimmicks are vital to every mobile fighting unit whether it wages battle on land . . . on sea . . . or in the sky. They are, in fact—ammunition!

These assorted fittings have been produced by the millions-per-week for war purposes in the four plants of The Weatherhead Company. And with Victory and Peace, they will become the ammunition with which we shall be prepared to help you build the better world for which we are all fighting.

Look Ahead with Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.*

Announcing the NEW 48-Page SCHERR CATALOG

Every SHOP NEEDS IT
Any SHOP CAN AFFORD IT!

This convenient, condensed catalog is a practical, useful text book on Inspection Equipment, prepared to meet the needs of busy men. It contains everything you want to know, including PRICES.

The SCHERR LIMITED BUDGET INSPECTION LABORATORY

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GEORGE SCHERR CO., INC., 124 Lafay

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George Scherr Co., Inc., 126 Lafayette St., New York 13, N. Y.

Kindly send copy of your new 48-Page Catalog of Inspection Equipment.

Name .....

Position .....

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City ..... State .....

Detachable work unit of new "TOCCO JR. 7½" conveniently mounted on bench in production line.

Announcing another LOW-COST TOCCO

To revolutionize heat treating in thousands of plants

TYPICAL RESULTS

BRAZING carbide tool tips—all sizes. Time: 10 to 50 seconds.

ANNEALING 75 mm. steel cartridge cases to 70-75 R.B. Time: 10 seconds.

HEATING to 2200° F. for forming 1" on end of 1" bars. Output: 90 per hour.

HARDENING wearing surface of teeth of small bevel gears. Time: 18 seconds.

The "TOCCO JR. 7½" offers thousands of shops a thrifty head start in the race for *better products at lower cost* with TOCCO Induction Heat Treating.

This new TOCCO has a DETACHABLE WORK UNIT which can be mounted on a suitable bench in the production line (as shown above), handy to related operations, with the power unit located wherever desired. This higher degree of versatility and adaptability of heat treating affords greater production flexibility for fast-moving manufacturers.

Here are the cost-cutting advantages of larger TOCCO machines in a complete motor-generator type induction heat treating unit at a new *low cost*. Output is 7½ K.W. (9600 cycles).

Write today for free descriptive bulletin on this new TOCCO.

THE OHIO CRANKSHAFT COMPANY • Cleveland, Ohio

TOCCO

HARDENING..BRAZING

ANNEALING..HEATING

★

Pile on the work . . . your

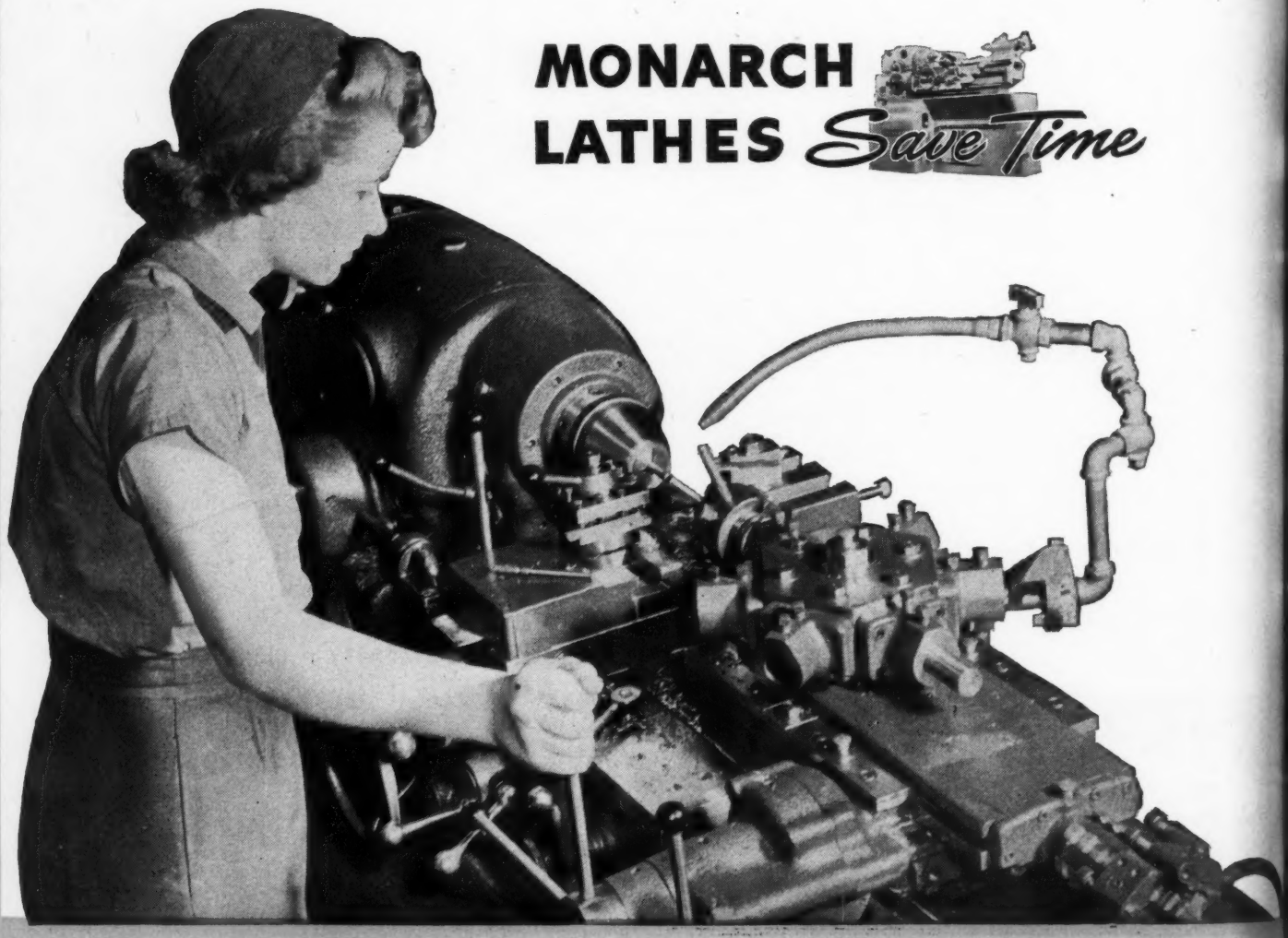
It's a bear for work, this Monarch Sensitive Precision Toolmaker's Lathe. Give it a job within its range, and you'll get it turned, quickly and accurately.

It's simplicity itself to operate. Inbuilt precision and sturdiness assure maintained accuracy on one-piece or repetitive work. Give it the aid of some of Monarch's special attachments, as illustrated, and watch the chips fly!

This Monarch lathe, like other members of the Monarch family, has done yeoman service in our war production program. When we return to peacetime products, you'll find it the time and moneysaving answer to thousands of lighter turning jobs for re-tooling or for mass production.

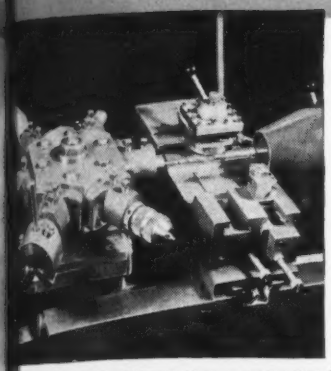
Pile on the work . . . your Monarch lathes can take it!

MONARCH LATHES *Save Time*



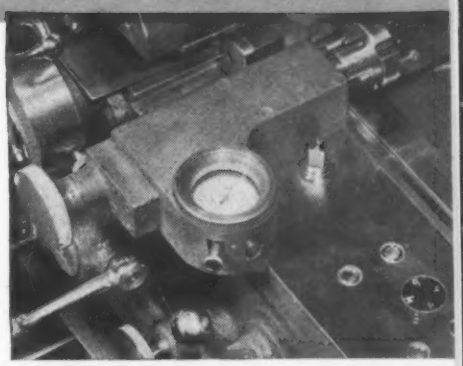
THE MONARCH MACHINE

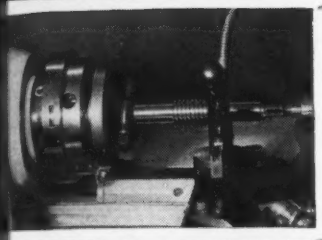
Monarch Lathes can turn it!



Hexagon ram-type turret, with hand-operated double connected slide and lever-operated drawing attachment, fits this Monarch toolmaker's lathe for practical turret lathe production of small parts, to the required accuracy.

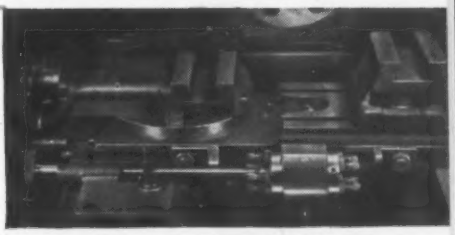
Dial-type diameter stop has dial indicator for both turning and boring, with four positions controlled by knurled knob.

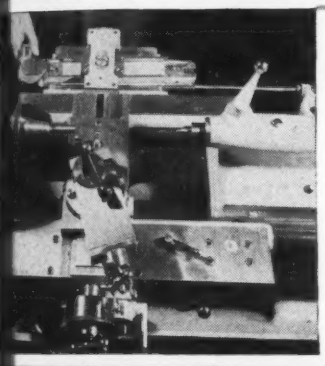




Multiple index faceplate provides accurate index of driver plate for chasing either external or internal multiple threads.

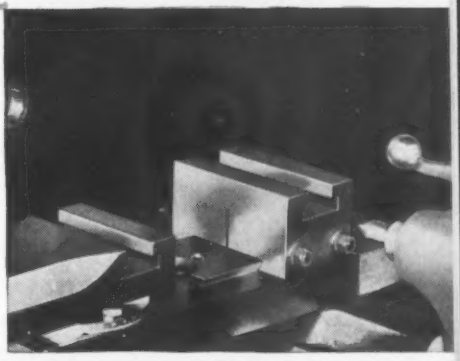
Multiple positive diameter stop has four positions for both turning and boring, brought into position by convenient knurled knob.

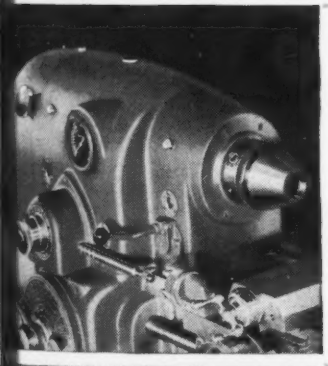




Taper turning attachment, with micrometer adjustment, for turning extremely accurate and smooth tapers.

Connected compound and plain block rear rest is especially useful for turning, necking or chamfering operations.

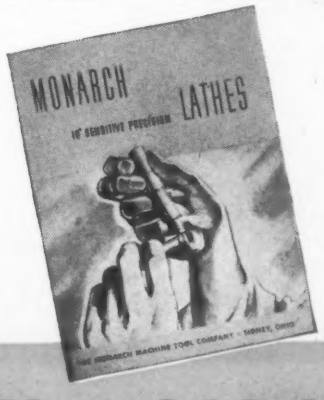




Lever-operated collet chuck is a great time saver on production jobs. A simple push releases the work and a pull tightens the work in the collet.

Floor-type cabinet and collet rack provides easy accessibility and convenient storage for chucks, rests, plates, wrenches, collets and tools.

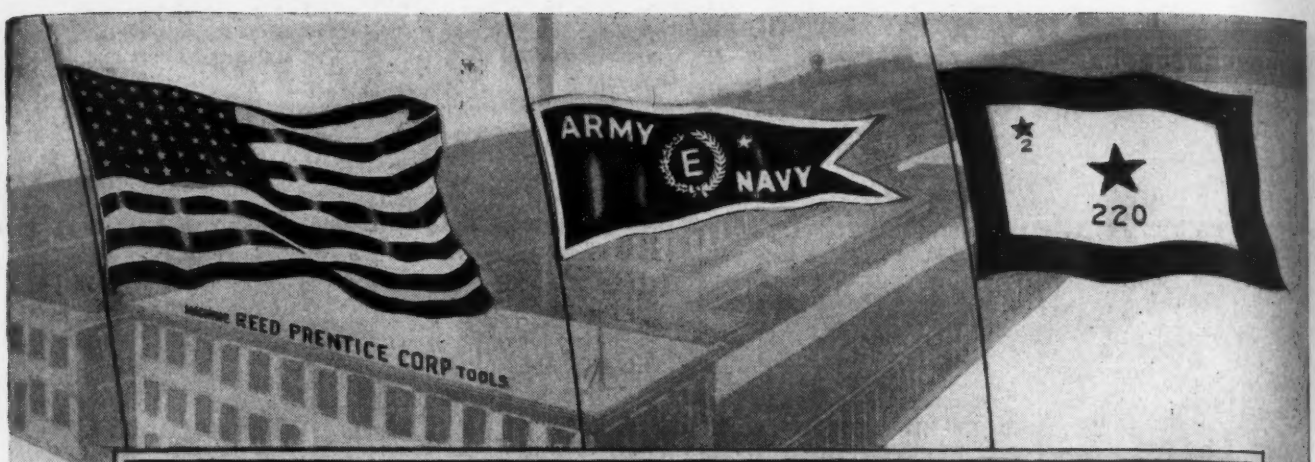
Multiple positive length stop has four positions and four micrometer heads for fine adjustments.



SEND FOR DETAILS!

Time and moneysaving features of Monarch 10" Sensitive Precision Toolmaker's Lathes and accessories are described in our Bulletin No. 10EF-F. Please ask for it on your letterhead as paper shortage limits distribution. Address The Monarch Machine Tool Company, Sidney, Ohio, or branch office listed in your telephone book.

TOOL COMPANY • SIDNEY, O.



STATEMENT of POLICY

Policy of the Reed-Prentice Corporation for the Present and the Postwar Period:

Present—

To manufacture finest quality machine tools for war production.

To utilize all our available surplus facilities for subcontract work for the United States Services.

To aid in winning the war at the earliest possible moment.

Postwar—

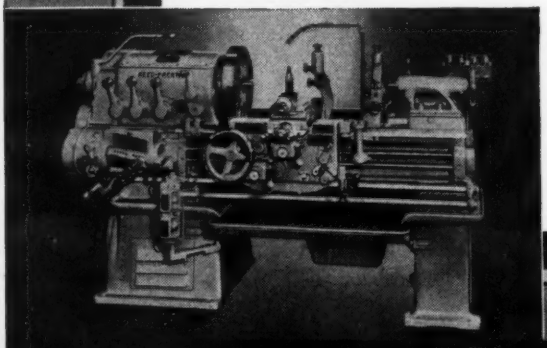
To provide employment for our former employees now with the armed forces.

To put into production the many machines which are now in the experimental stage.

To build our products, incorporating the latest proven devices, in such a manner that new markets will be opened because of obsolescence of present day equipment.

To stick to the type of machines which seventy-five years of experience have taught us to build, and build well.

To incorporate into those machines, the very best of materials and workmanship.



Reed-Prentice Corporation

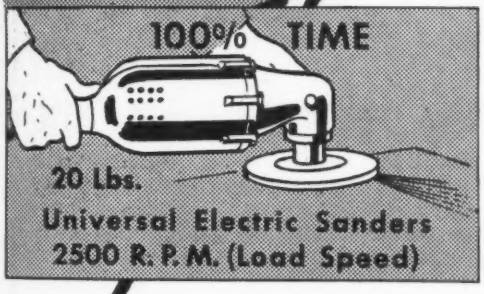
Manufacturers of engine and toolroom lathes, vertical milling machines, die casting machines, plastic injection molding machines and portable "Timberhog" chain saws for timber cutting.

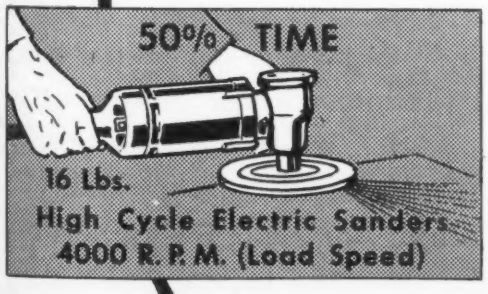
BRANCH OFFICES
1213 W. 3rd. St.
Cleveland, Ohio
75 West St.
New York City, N. Y.

REED-PRENTICE CORP.

MAIN OFFICE
WORCESTER
MASS. U. S. A.

DOWN WENT HER SANDING TIME 50%





Sight of that Jap-blaster, going down the ways, warms my heart—especially since the R.A.E. and I had a hand in speeding her construction.

It was in sanding her welded battery racks. Six men were using universal electric sanders—9″ pads—at a speed that dropped to 2500 R.P.M. under load. Maintenance cost was high.

They called in the Rotor Application Engineer.

He surveyed the job and recommended the *right tools* for it—Rotor High Cycle Electric right-angle sanders. They hit it up at a load speed of 4000 R.P.M. Results:

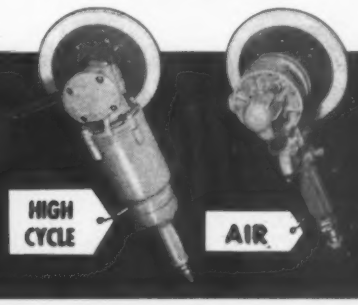
1. Because of higher speed under load, three Rotors now do the work of the six universals.
2. Man-hours were cut 50%.
3. Rotor Sanders weigh 4 lbs. less; are easier to handle.
4. Tool maintenance is less.

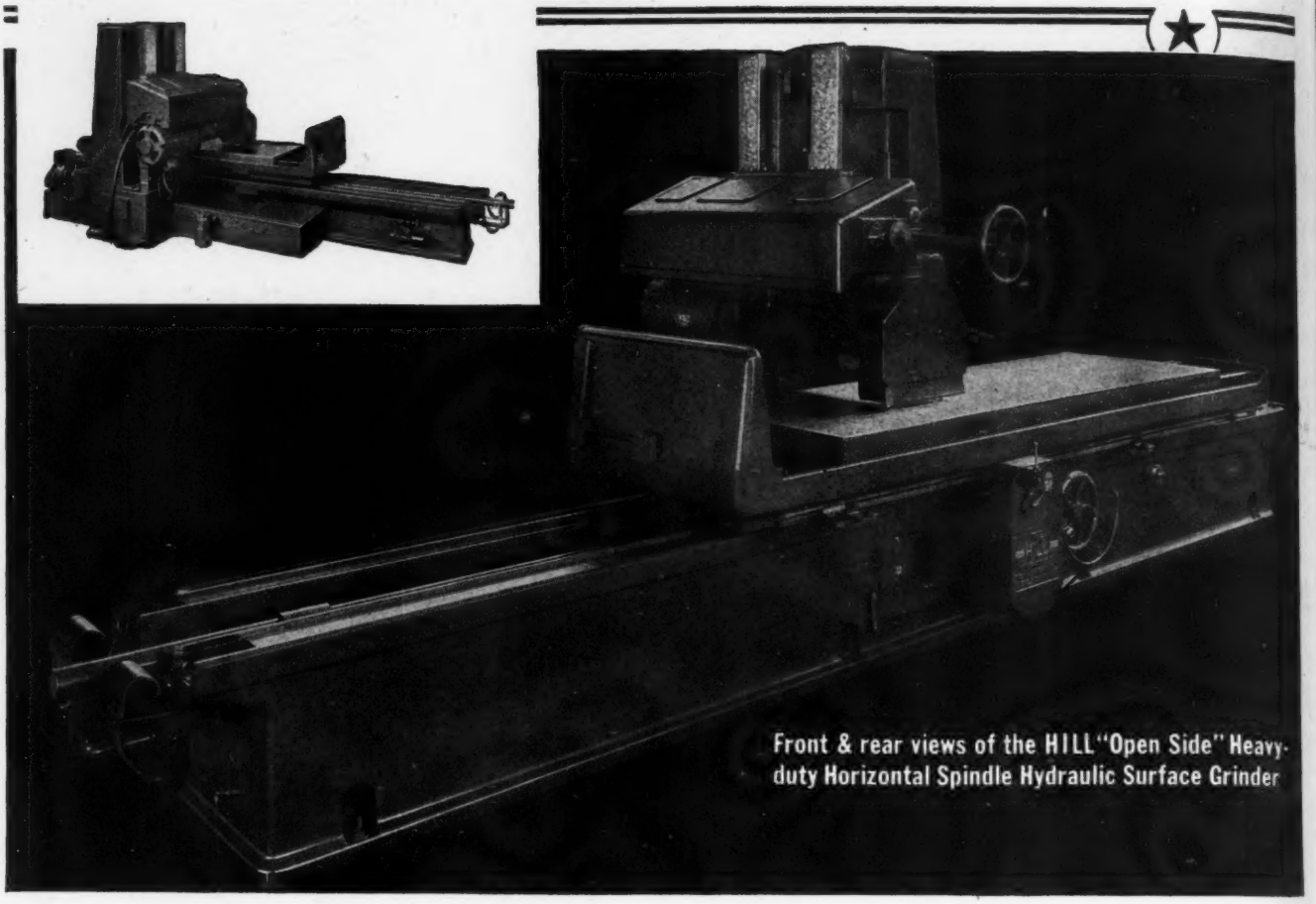
Perhaps your sanding and grinding time and costs could be given a similar launching to a sub level. We're at your service . . . gratis of course.

Yours for the *right tool.*

HIGH CYCLE O'TOOL

THE ROTOR TOOL CO.
CLEVELAND, OHIO





Front & rear views of the HILL "Open Side" Heavy-duty Horizontal Spindle Hydraulic Surface Grinder

★ ★ ★ *easy to operate* —

CONTROLLED PRECISION

HORIZONTAL

VERTICAL

Today's *man power* problems make it imperative that machine tools be easy to operate so that inexperienced operators can quickly learn—yet precision work is demanded today as never before. HILL "Open Side" Hydraulic Surface Grinders hold the answer to both problems. In a remarkably short time, men transferred from non-essential industries are being trained to produce finished parts ground to close tolerances. We will gladly furnish you with names of HILL "Open Side" Grinder users in your territory—Ask THEM what THEIR HILL Heavy Duty Precision Grinders are doing, or send for Bulletin H-V-3 and be your own judge from the facts presented.

The HILL ACME CO.

6400 BREAKWATER AVE • CLEVELAND, OHIO

A 70 TON PULL

With its 2000 horsepower engine opened up, this 13 foot propellor exerts a pull estimated at 70 tons on the Fafnir blade bearings . . . a vivid example of power and speed carried frictionlessly on ball bearings.

After the heavy raid of the American 8th Air Force on Schweinfurt, center of Germany's ball bearing industry, the official report read in part:

"These Schweinfurt plants turned out a tremendous amount of ball bearings for German war machines.

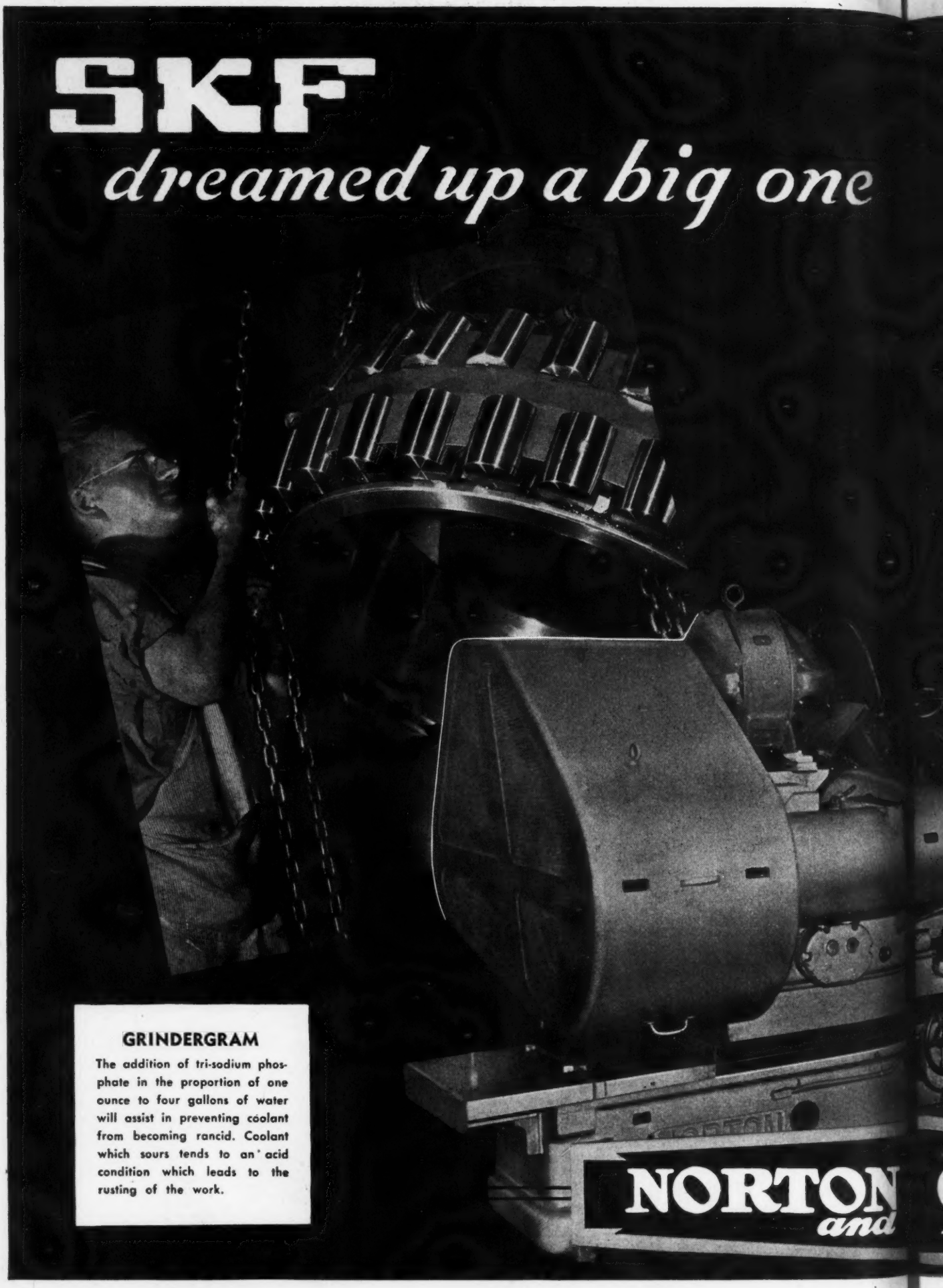
"All high speed moving parts depend upon ball bearings to eliminate friction. They must have ball bearings to operate war equipment. This attack . . . amputates a huge part of the Nazi's ability to keep moving machinery in operation."

In a mechanized war, friction can be as destructive as enemy bullets. That is why ball bearings are at the "turning points" of practically every piece of fighting equipment.

Millions of Fafnirs are proving their worth in America's fighting machines and in busy industrial machines here at home. Their worth will be just as steadily proved in the machines and vehicles of the peaceful world toward which we fight. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR ARMY-NAVY E **BALL BEARINGS**

SKF
dreamed up a big one



GRINDERGRAM

The addition of tri-sodium phosphate in the proportion of one ounce to four gallons of water will assist in preventing coolant from becoming rancid. Coolant which sours tends to an acid condition which leads to the rusting of the work.

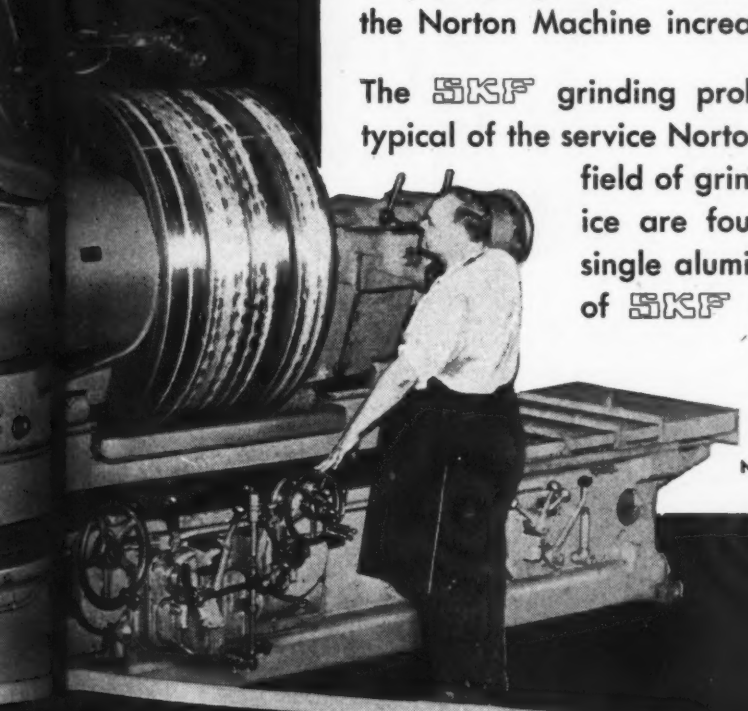
and NORTON BUILT A GRINDER TO MAKE IT POSSIBLE

THE roll neck bearings of the huge mills producing sheet aluminum in quarter-mile-long strips are really *big* ones.

To insure that this production of the light, bright metal—vital to the Nation's growing air supremacy — continue uninterrupted, SKF expanded its production of the smooth-running SKF Spherical Roller Bearings. Part of this expansion program included an extra-capacity Norton Grinder large enough to finish two 48-inch bearing outer races in a single set-up.

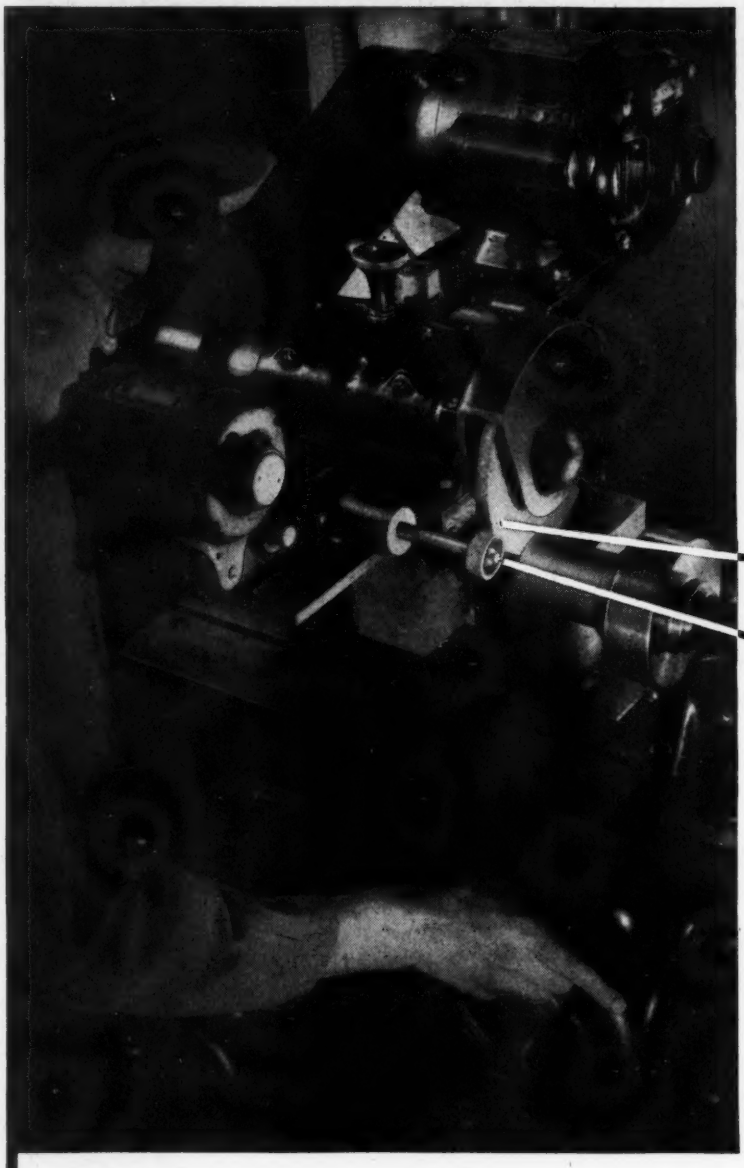
"It has taken large-scale engineering imagination to develop these huge bearings, and the machines and the methods of producing them," comments SKF in reporting that the Norton Machine increased production 600%.

The SKF grinding problem and its happy solution is typical of the service Norton Company renders in the entire field of grinding. The rewards for such service are found in the statement — "Not a single aluminum mill has been idle for want of SKF bearings."



NORTON COMPANY
Worcester 6, Mass.
New York - Chicago - Detroit - Cleveland - Hartford

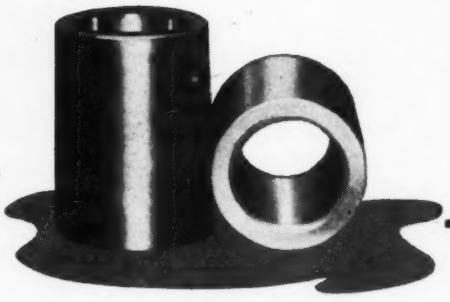
GRINDERS
Lappers



TWIN MOUNTED

for external and internal grinding!

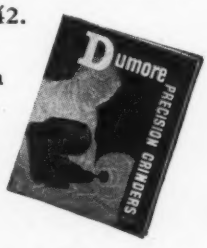
Two DUMORES on one set-up assure concentricity and cut handling time.



The job illustrated is a sleeve bushing, both internal and external diameters to be ground, concentricity to be held within .0005 inch. Two Dumore Precision Grinders mounted on the base enabled both grinding operations to be performed at one chucking. This method makes concentricity easy to obtain, at the same time cuts handling time almost in half. This is one of the numerous ingenious arrangements of Dumore Precision Grinders which are facilitating war production in plants throughout the country . . . examples of the remarkable adaptability of Dumore Grinders to a wide variety of production applications.

For helpful suggestions and full details of all models, ask for Catalog 42.

The Dumore Company, Grinder Division, Racine, Wisconsin



Dumore

PRECISION and Off-Hand GRINDERS

DUMORE GRINDERS ARE SOLD BY AUTHORIZED DISTRIBUTORS IN ALL PRINCIPAL CITIES

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

U. S. A.

REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower • Cleveland: 402 Swetland Building

Chicago: 902 S. Wabash Ave. • Los Angeles: 5410 Wilshire Blvd.

A flexible machine that is the last word in simplicity of operation

HI-SPEED HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36″ stroke with 80″ under the spindle.

HONES CYLINDERS up to 20″ in diameter . . . with STROKES from 20″ to 72″ . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72″ . . . Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20″	36″	48″	72″
Working Base Area (standard) . . Auxiliary Tables available	21″ x 22″	31″ x 31″	31″ x 31″	48″ x 54″
Height Under Spindle Nose (up) . . Added Height Available on Order.	48″	60″	75″	100″
Spindle Diameter	2¼″	2¼″	2½″	2¾″
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor . .	10″ Dia.	12″ Dia.	16″ Dia.	20″ Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18″	27″	27″	44″
Floor Area	44″x60″	60″x80″	60″x80″	60″x108″
Overall Height	11′6″	15′3″	18′3″	23′8″

ARMY E NAVY

Over our factory flies the ARMY-NAVY "E"—awarded for excellence in the production of machinery and tools vitally needed to win the war.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

UNION

For Wartime Tool Economy

Present conditions make it vitally important that maximum service be obtained from every small tool. One of the first steps toward tool economy is to choose tools that are known for their ruggedness and longer lasting accuracy.

Choose UNION Tools — treat them well — and you will see the results of your economy in the longer accurate service and uninterrupted production you get from every tool bearing the UNION name.

UNION TWIST DRILL CO.
ATHOL, MASS.

S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec.

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Divisions of the UNION TWIST DRILL CO.

UNION BUTTERFIELD CARD

THE **Right** REAMER FOR EVERY WARTIME JOB

Butterfield

Today's problem is to combine maximum efficiency and unquestioned accuracy in the production of parts for ships, guns, tanks, shells and planes. In plants where war production records are being set, Butterfield Reamers are turning out work that meets rigid standards of precision and, at the same time, demonstrating their ability to give long, economical service. The completeness and the uniformity of the Butterfield line make it possible to choose the "one best" tool for every job from this single convenient source of supply.

Divisions of the

UNION TWIST DRILL CO.

BUTTERFIELD DIVISION

DERBY LINE, VT. ROCK ISLAND, QUE.

STORES: New York, 61 Reade St. Chicago, 11 So. Clinton St. Cleveland, Hal. W. Reynolds, 3346 Superior Ave. Detroit, 6540 Antoine St. Los Angeles, 524 E. Fourth St. Toronto, 137 Wellington St., West. Montreal, 111 St. Paul St., West. Winnipeg, 403 Travellers Bldg. Vancouver, B. C., Shelly Bldg. Agents for Great Britain—Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S. E. 11, England. Branches at Birmingham, Manchester, Glasgow, Newcastle-on-Tyne and Bristol.

UNION BUTTERFIELD CARD

CARD

A PRECISION PRODUCT . . . A LIFETIME OF PRACTICAL EXPERIENCE

For over 65 years, we have been making Card Taps for precision applications in every industry. Today, more than ever before, higher standards of accuracy, tougher, harder materials and increased production schedules call for superior tools. For your war production needs, choose your taps from the complete line made by the Card organization of tap experts . . . and get the added value of our lifetime of knowledge of every angle of tap use.

S. W. CARD MFG. CO.
MANSFIELD, MASS.

STORES

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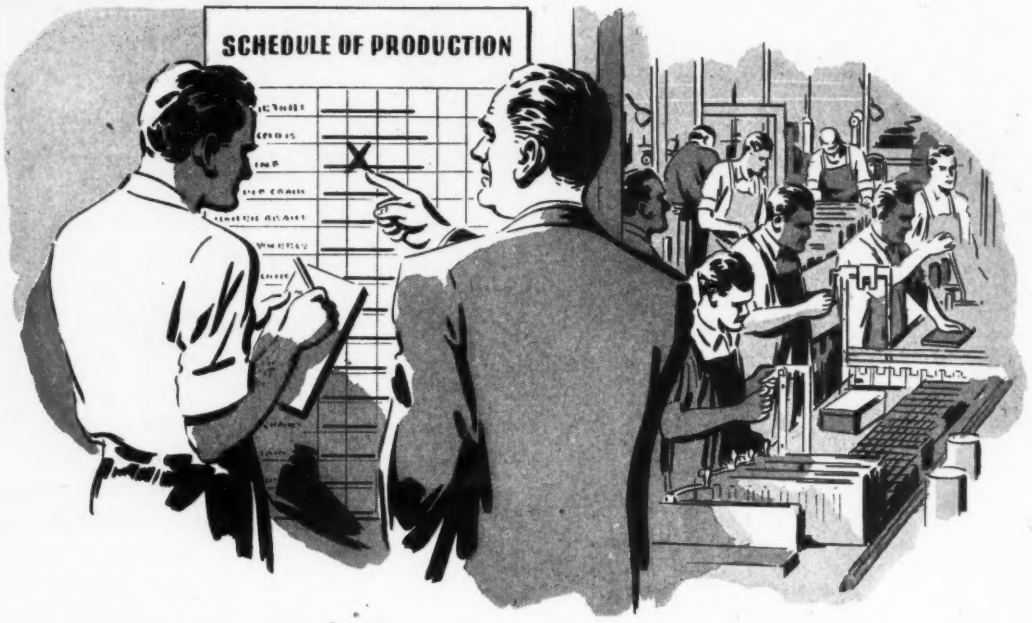
San Francisco: 121 Second St.
Los Angeles: 524 E. Fourth St.
Seattle: 568 First Ave., South

Divisions of the
UNION TWIST DRILL CO.

UNION BUTTERFIELD CARD

IS THERE One Part IN YOUR PLANT THAT'S A "WALLFLOWER"?



HAS one difficult part become chronically "unpopular" in your production line? Do excessive rejections of certain parts lower the standards of production on other related parts? When V-Day comes, will that troublesome or hard-to-get part hinder your progress?

Contact KAYDON

To make the most of opportunities offered by the new, lighter, stronger metals and plastics . . . to eliminate current problems in war production, or to release capacity for postwar product planning . . . delegate your difficult parts to Kaydon. Here you will find engineering resourcefulness fortified by unusual precision experience . . . to assure maximum production per manhour, and lower costs, on difficult parts. Phone, wire or write . . .

CAPACITY Immediately AVAILABLE for ball and roller BEARINGS Size 6" to 60"

For excellence in production of extremely precise, unusually large ball and roller bearings.

THE KAYDON ENGINEERING CORP.

McCRACKEN STREET • MUSKEGON, MICH.

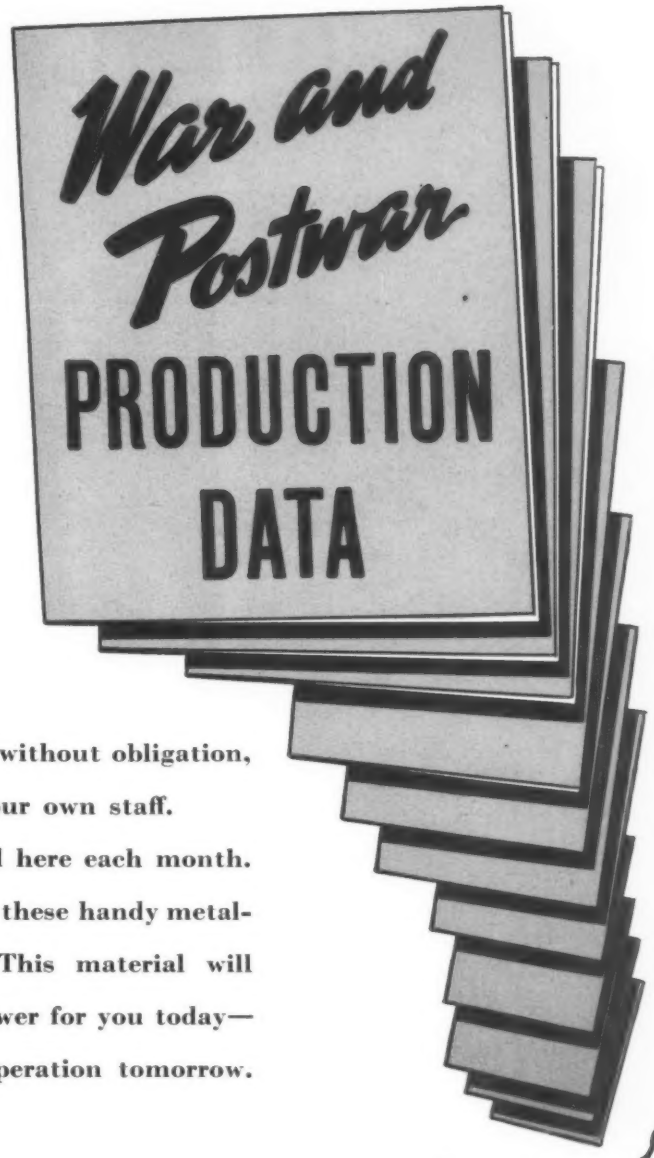
Specialists in Difficult Manufacturing

Each month the Rockford manufacturers represented here present practical, production ideas for the metal-working industry. To provide you with additional information and a more complete description of the machinery, equipment and services available in Rockford, these firms have prepared descriptive booklets and bulletins.

Each of these booklets contains suggestions that may help you save time and money in today's war production. They will also provide valuable file information for use when you retool for peacetime work.

In addition, they describe the complete engineering service of each manufacturer in his specialized field. These engineering services are available to you, without obligation, to supplement the facilities of your own staff.

Read the information presented here each month. Write today for your free copies of these handy metal-working production references. This material will mean savings in time and manpower for you today—a suggestion for more efficient operation tomorrow.



CENTER OF MACHINE TOOL PRODUCTION . . .

BROACHING BY American-

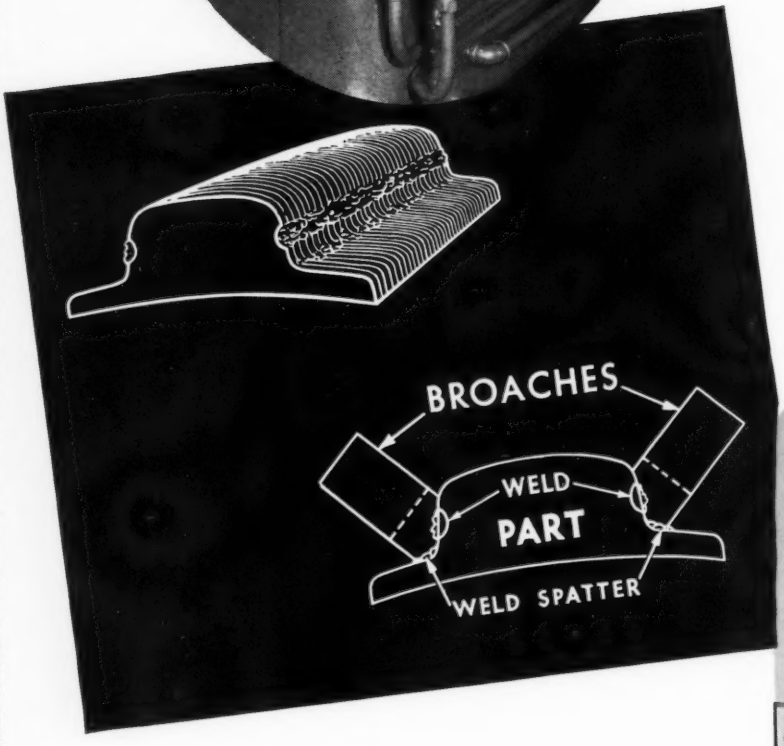
FOR ECONOMY!

Time, money, materials and manpower are often saved by completely altering a method of fabrication to make use of broaching.

The pole shoes shown on the table of the American SB-42-10 vertical hydraulic single ram surface broaching machine at left, were previously formed from a solid bar. By welding together stamped laminations and removing excess weld with broaching—two parts at a time—costs were sharply cut and output increased!

This is just one of many ways in which broaching enters into product design or re-design to achieve higher production at lower unit cost.

Principals of American Broach and Machine Company, identified with broaching since the turn of the century, offer a *complete* broaching service—machines, tools, and engineering. Their consultation services and facilities are at your entire disposal.



BROACHING IS BETTER
THE *American* WAY

American
BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN
•
BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

MADE IN
ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP
ILLINOIS, U. S. A.

HYDRAULIC
POWER
Straightening
PRESS

10 TON CAPACITY YET SENSITIVE ENOUGH TO BEND SHAFT A MINIMUM OF .001"

Model HP-010-P

Speed Up Your Checking and Straightening Jobs

The latest and most practical type of power press . . . sensitive, speedy, accurate. Developed to supplement the highly successful line of Anderson Hydraulic Hand Presses. With a capacity up to 10 tons it is so sensitive and so accurate that a shaft may be bent as little as a .001 of an inch.

The pressure gauge, indicating ram loading, is mounted near the work at eye level to facilitate quantity production. Beneath the ram, at the point of maximum deflection of the work piece, is located an adjustable dial indicator. This indicator clearly shows amount of shaft run-out in pre-loaded, fully loaded, and unloaded positions.

Use of the Hydraulic system on this press provides distinct advantages over conventional types.

A flexible, sensitive control of press is made possible by means of a unique rotary control valve. This valve is operated from the front of the machine by a control lever which, when depressed, causes a corresponding increase in the load applied to the work. An infinite range of loading up to capacity is obtainable as the lever is moved from 0 to maximum displacement. Push button control of the hydraulic unit is provided for starting and stopping, although no load can be applied to the ram until the lever is depressed.

The length of press work table is 60 inches. Available table attachments include checking rolls, spring loaded centers, adjustable anvils and indicator. To further aid production speed, an adjustable stop collar is provided which may be used to limit the 6" maximum stroke of the ram. Hand operated control equipment is standard but extra provision can be made for foot operation upon request.

QUICK FACTS

- Unique rotary control valve assures flexibility and sensitive control.
- Push button control of hydraulic unit.
- Ease of operation through complete command of control lever.
- High rate of production because press checks and bends in same position and because rapid ram return speed reduces loading and unloading time to a minimum.

Write for Bulletin 26

ANDERSON BROS. MFG. CO.
Anderson
ROCKFORD, ILL. U.S.A.

ANDERSON BROS. MFG. CO., ROCKFORD, ILL.

MADE IN
FOR RIGID ACCURACY IN MACHINE TOOLS... **ROCKFORD**
ILLINOIS, U. S. A.

How to Get the Most Economical Solution to Your Turning Problem!

Whether It is a Mass Production... a Short Run... or a Special Turning Job, Sundstrand Engineers Can Solve It...

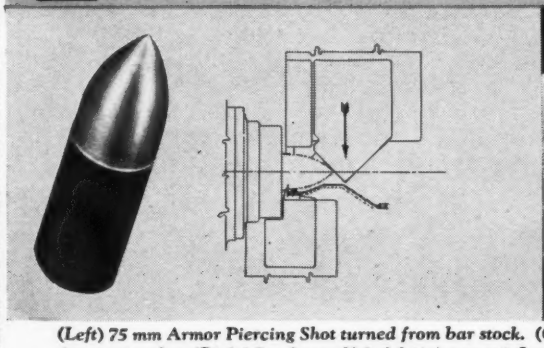
Whether your turning problem is a mass production job running into thousands of pieces...a short run of as few as 25 pieces...or a special turning job, Sundstrand Engineers will show you how it can be handled to advantage on Automatic Lathes with quick cycle changeover.

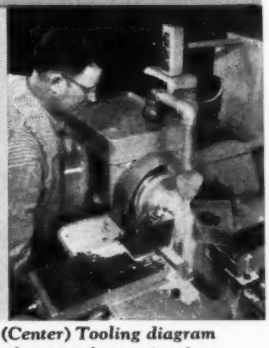
All of the advantages of multiple tool turning are available on both short run and mass production work with Sundstrand Lathes. To meet a wide range of applications three models of Sundstrand Automatic Lathes are available. These standard models, furnished with either two or three tool carriages, can be made even more flexible and adaptable to additional jobs with several available auxiliary attachments.

Described here are three typical cases in which Sundstrand Engineered production assisted plant engineers in designing a tooling method which resulted in higher production, lower turning costs.

Here's How *Sundstrand* Automatic Lathes were Adapted to these Three Different Jobs . . . . .

1 A Mass Production Job!





(Left) 75 mm Armor Piercing Shot turned from bar stock. (Center) Tooling diagram for turning shot. (Right) Sundstrand Model 12 Automatic Lathe set up for turning shot.

Turning 75 mm Armor Piercing Shot...

Starting from bar stock the Sundstrand Automatic Lathe contour turns and forms the nose of 75 mm shot. Highly skilled operators are not necessary in order to rapidly and accurately duplicate parts on a Sundstrand. Just load, unload, and press the machine starting lever...the front and rear tool slides will rapid approach, feed, rapid return, and stop, all timed and interlocked with the starting and stopping of the machine spindle and coolant flow. Oftentimes, one operator can run one or more machines, depending upon the cycle time.

ARMY-NAVY

SUNDSTRAND MACHINE TOOL CO. · ROCKFORD, ILLINOIS, U.S.A. ·

SUNDSTRAND

Rigidmils • Fluid-Screw Rigidmils • Automatic Lathes • Hydraulic Equipment

2530 ELEVENTH STREET

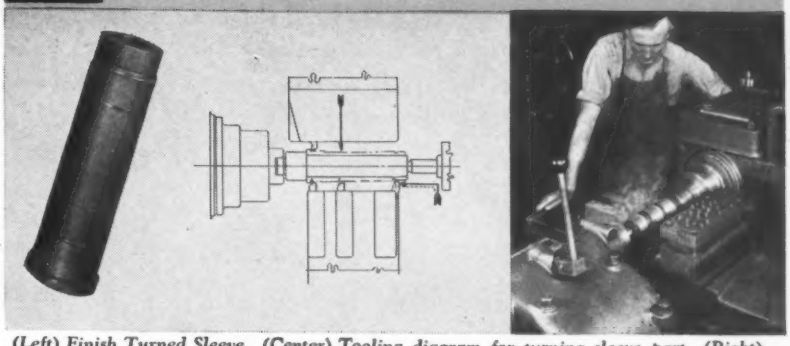
MADE IN ROCKFORD... FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

ILLINOIS, U. S. A.

2 A Short Run Turning Job!

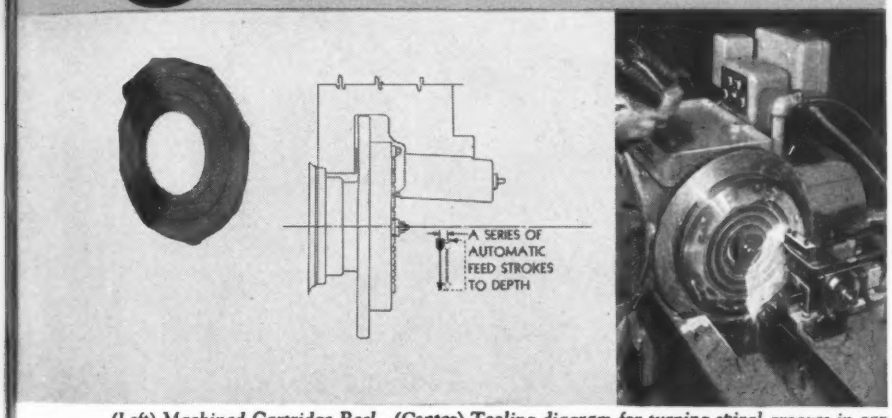
Turning Time Reduced from 75 to 8 Min. on Lots of 40...

Due to the quick changeover features of the Sundstrand Automatic cycle, it is possible for this manufacturer to turn many of his jobs in lot sizes as low as 25. On one lot of 40 sleeves, his turning time was cut from 75 to 8 minutes. Other parts turned include sprockets, pulleys, gears, etc., with lot sizes of 25 to 100 pieces. Two Model 10 Sundstrand Automatic Lathes are used with one man operating both machines. Over 100 different short run jobs are turned on these machines.



(Left) Finish Turned Sleeve. (Center) Tooling diagram for turning sleeve part. (Right) Two Sundstrand Model 10 Automatic Lathes for rough and finished turning sleeve blanks.

3 A Special Turning Job!



(Left) Machined Cartridge Reel. (Center) Tooling diagram for turning spiral grooves in cartridge reels. (Right) Sundstrand Model 12 Automatic Lathe set up for cutting spiral grooves in cartridge reels.

Cutting Spiral Grooves in Cartridge Reels...

Sundstrand Engineers designed a number of special features and a unique tooling method for a Model 12 Sundstrand Automatic Lathe in order to provide a complete automatic cycle necessary for cutting a spiral groove on a cartridge reel. Because of the frailness of the part and the odd shape of the groove, it was not possible to cut this spiral groove to full depth in one cycle. The machine is arranged to automatically cycle 35 times and then stop. Tool is advanced .002" between each cycle so that a groove .070" deep has been cut at the end of the 35th cycle.

How You Can Use Sundstrand Engineered Production

A competent staff of engineers is available to study your turning problems and show you how you can increase production and lower costs with Sundstrand Automatic Lathes. Let these engineers assist you in the selection of the correct automatic lathe for your job and determine the most effective method of tooling. Just send complete and accurate information on your specific turning job for a free preliminary analysis.

More Turning Facts

Get additional information on how you can turn both short run and mass production work faster in this free booklet describing the features of the Sundstrand Automatic Lathe. Quick set-up and easy changeover features are described in detail. 22 front and 6 rear carriage cycle diagrams are also illustrated. Write for your copy today. Ask for Bulletin No. 621.

MACHINE TOOL CO.

Drilling and Centering Machines • Special Milling and Turning Machines

ROCKFORD, ILLINOIS, U. S. A.

MADE IN

CENTER OF MACHINE TOOL EXCELLENCE... **ROCKFORD**

ILLINOIS, U. S. A.

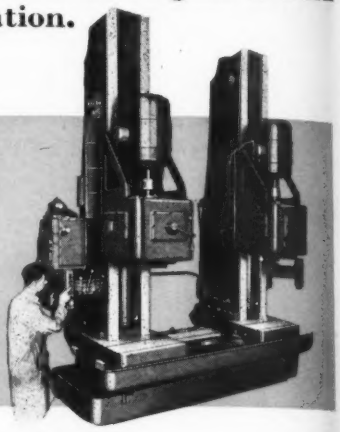
HOW and WHY

These Manufacturers Use Barnes Unit-Type Hydraulic Circuits

...when designing new equipment

Here are but three of the many ways in which progressive manufacturers are using Barnes Unit-Type Hydraulic Circuits. Perhaps an analysis of your present designs will also reveal a better way to do it hydraulically. Our engineers will be glad to work with you on new designs or changeovers. There is no obligation.

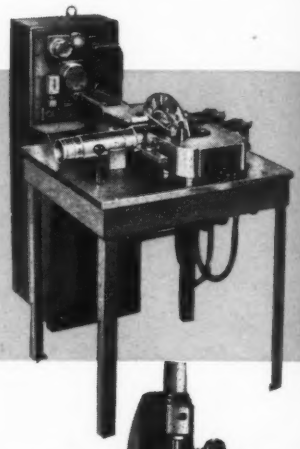
FOR SPECIAL PRODUCTION MACHINE TOOLS



HOW: This manufacturer uses Barnes Hydraulic Units for actuating the vertical heads of this connecting rod boring machine.

WHY: The complete designing and manufacturing of the machine was being done while we designed the hydraulic structure. Both design and assembly time were cut to a minimum.

FOR COMPACT RIVETING MACHINES



HOW: This manufacturer incorporated the hydraulic unit as an integral part of the design of this 15 ton capacity riveter. Presenting his problem to Barnes in its early stages made this possible.

WHY: To get a riveter with a rapid and smooth stroke in the shortest possible time and with a minimum of equipment.

FOR HYDRAULIC PRESSES

HOW: This manufacturer designed this press to supplement his line of smaller hand presses. The press capacity is 10 tons and so sensitive it can be used to bend a shaft as little as .001″.

WHY: To obtain ease of operation; flexible, sensitive control; high production possibilities; and safety of operation.

HERE'S HOW YOU CAN BENEFIT WITH BARNES HYDRAULIC UNITS

When designing or redesigning your machines you can save design and assembly time, improve machine performance and speed delivery by using the Barnes Unit-Type method of securing hydraulics. You merely establish the functions to be done hydraulically—our engineers will design the proper circuit and unit while you design the machine itself. All hydraulic elements come from one source—eliminating divided responsibility for the hydraulic performance of your machine.

BARNES hydraulics

FREE DATA *Get additional facts from this booklet containing detailed descriptions of Barnes Hydraulic Elements and typical installation circuits. Send today for your free copy of Booklet M244.*

John S. Barnes Corporation ROCKFORD, ILLINOIS

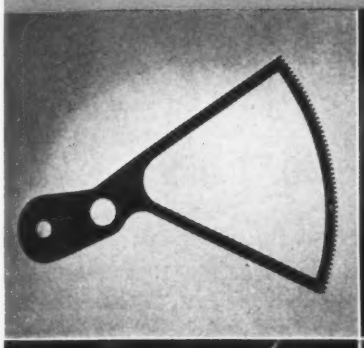
MADE IN

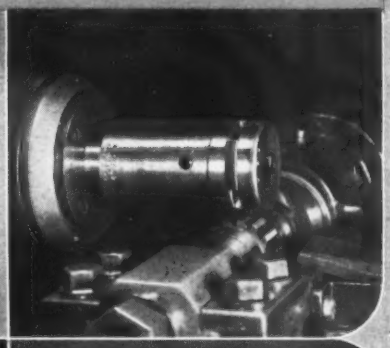
ROCKFORD... FOR ACCURATE, FAST METAL REMOVAL

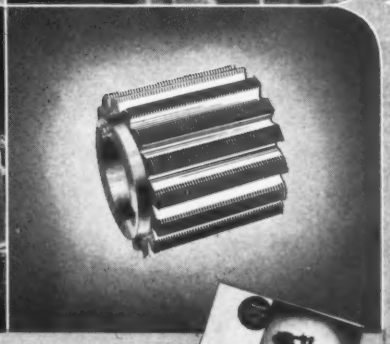
ILLINOIS, U. S. A.

Another Hobbing Solution From The BARBER-COLMAN Hobbing Service

Hobbing 180 Pitch Sector Gears Within .0003″ Accuracy on Pitch Line Circle







How You Can Use the Barber-Colman Hobbing Service

If you have work similar to this or other hobbing problems, it may be possible to lower production costs or increase output by the application of B-C Machines and Hobs. Let B-C Hobbing Engineers make an analysis of your work and recommend the proper machines or hobs needed. There is no obligation.

For additional information on the B-C No. 3 Hobbing Machine, write for free copy of Bulletin F 812.

Barber-Colman Company

GENERAL OFFICES AND PLANT • 109 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

MANUFACTURERS OF HOBS, CUTTERS, REAMERS, HOBBING MACHINES, SHARPENING MACHINES

The Problem:

A prominent gear manufacturer was faced with the problem of cutting 180 pitch sector gears, .0159″ wide with 1.770″ O.D., 1.759 pitch diameter, (318 teeth in full circle). Made from half hard brass, these gears require a very fine finish with accuracy on the pitch line circle held within .003″. To provide the perfect oscillation required of these gears, no backlash was permitted.

The Solution:

A Barber-Colman Standard No. 3 Hobbing Machine with Barber-Colman Ground Topping Hob cuts these sector gears, 10 per load, in a total floor-to-floor time of 30 minutes. A feed of .0085″ and a speed of 309 r.p.m. are used.

The Machine:

This job once again illustrates the all-around versatility of the Barber-Colman No. 3 Hobbing Machine. This general-purpose Hobbing Machine easily maintains the extra fine finish and accuracy required for jobs like this because its features include wear adjustments for maintaining original machine accuracy throughout a long life. In addition to handling regular spur and helical gears, spline shafts and other hobbed forms, the No. 3 Machine can easily be adapted to other specific classes of work through the addition of many special attachments.

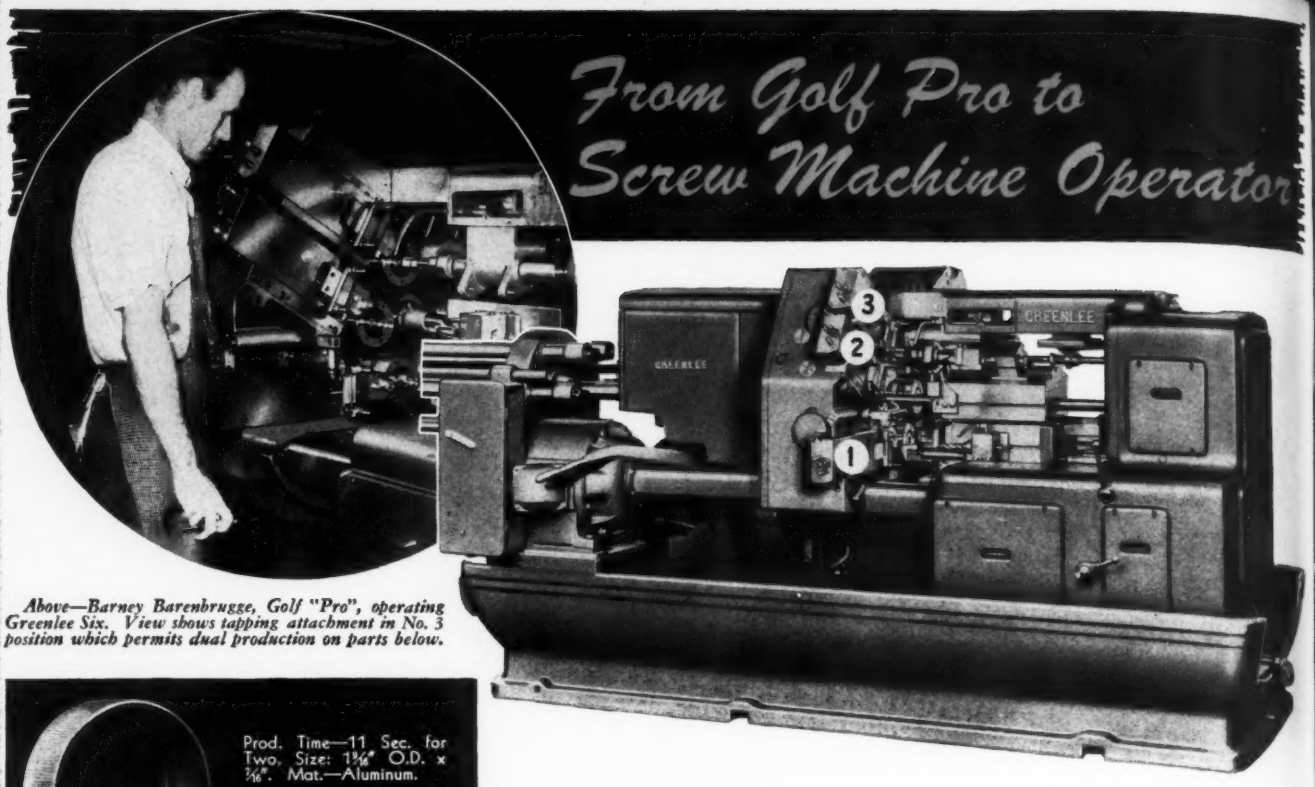
The Hob:

Barber-Colman Ground Topping Hobs, 1¼″ dia., 1¼″ length, with ¾″ straight bore, were used on this sector gear job. The use of a ground topping hob resulted in obtaining the required accuracy of the O.D., the accuracy of tooth form and the extra fine finish. This job is another example of how the combination of Barber-Colman Hobs and Hobbing Machines results in accurate, economical high production of gears.

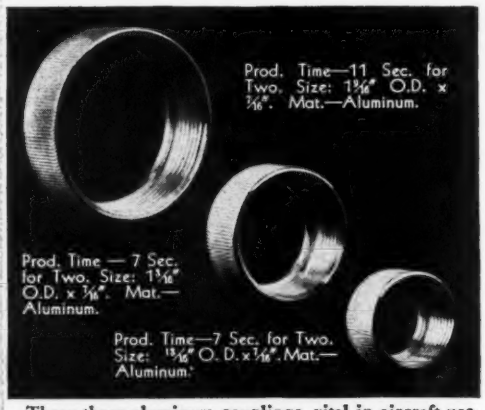
MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... ROCKFORD ILLINOIS, U. S. A.

From Golf Pro to Screw Machine Operator



Above—Barney Barenbrugge, Golf "Pro", operating Greenlee Six. View shows tapping attachment in No. 3 position which permits dual production on parts below.


Prod. Time—11 Sec. for Two. Size: 1 5/16" O.D. x 3/16". Mat.—Aluminum.
Prod. Time — 7 Sec. for Two. Size: 1 5/16" O.D. x 3/16". Mat.— Aluminum.
Prod. Time—7 Sec. for Two. Size: 13/16" O. D. x 1/16". Mat.— Aluminum.

These three aluminum couplings, vital in aircraft use, are produced on a 1⅝" capacity Greenlee Six. The machine is tooled with a dual set-up . . . two parts are produced simultaneously.

The following tooling set-up, used by Chicago Metal Hose Corp. to produce couplings, illustrates the easy application of tools on a Greenlee Six.

SEQUENCE OF OPERATIONS

1st Position
Form two pieces. Drill small hole for two pieces.

2nd Position
Knurl two pieces. Tap drill 1st piece.

3rd Position
Tap 1st piece. Cut off 1st piece.

4th Position
Tap drill 2nd piece.

5th Position
Tap 2nd piece.

6th Position
Cut off 2nd piece.

Machine equipped with lead screw for precision threading and tapping. Large part run at 900 R P M; small parts 1100-1300 R P M.

NOTE: *Free reprints of this ad are available to companies wishing them for labor recruitment, etc.*

ON A GREENLEE 6-SPINDLE AUTOMATIC

★ For thirteen years, Barney Barenbrugge, professional, plied his woods and irons over the fairways to master the game called golf. But, today, like other Americans, he's busy with another profession — helping Uncle Sam win a war!

Fifteen months ago, he was assigned to the job of running Greenlee 6-Spindle Automatics in the plant of Chicago Metal Hose Corporation. He'd had no previous machine experience. Before Pearl Harbor he had never worked in a shop.

But, with thoroughness, he applied himself to this new study of angles, timing and rhythm. He learned rapidly — found his new job interesting. Step by step he studied the fundamentals. Soon, he was able to make tooling changes and precision adjustments, quickly and easily. Today, he operates a Greenlee with the proficiency of a production professional.

Today, with a trade as well as a profession, he aids his Company and his Country to "back the attack." He is producing, on the Greenlee, thousands of precision parts that are machined right to reach the fight. Three of these parts, each produced *two at a time* on a dual set-up, are shown above.

For detailed facts on features of Greenlee 6, write

GREENLEE BROS. & CO.
1862 MASON AVE., ROCKFORD, ILLINOIS

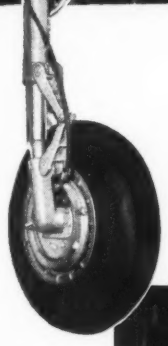
GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

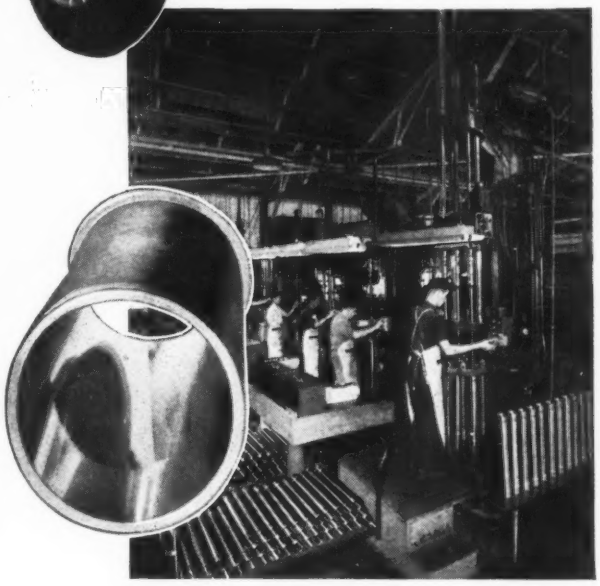
MADE IN ROCKFORD... MACHINE TOOL SHOPPING CENTER ILLINOIS, U. S. A.

How Honing Provides "Aircraft Precision" in Finishing Operations

(Above) A battery of BARNESDRIL Honing Machines used for honing aircraft landing gear cylinders. Honed diameter is 3¼" x approximately 18" in length.



(Left) A typical retracting type landing gear used on one of our Navy's fighting planes.



(Above, left) A honed landing gear cylinder showing resulting mirror finish.

(Above) BARNESDRIL Honers used for finishing oleo tubes and landing gear hydraulic cylinders.

What is "Aircraft Precision"?

"Aircraft precision" is the high degree of finishing perfection required for dependable, accurate performance of airplane parts. To meet strict aircraft requirements for precision production, the use of *honing operations* on engine cylinders, landing gear struts, master and articulating rods, propeller parts and many other vital aircraft parts has been widely adapted. Honing removes roughness and other inaccuracies from prior machining operations. Final precision sizing and finishing are accomplished by simultaneous rotations and reciprocations of an expanding hone within the bore.

Why You Get "Aircraft Precision" By Honing

Provides Final Size Accuracy Within .0005" to .001"—In addition to any desired surface finish, honing provides final accuracy of both roundness and straightness of bore and final dimensional size accuracy.

Provides Surface Finish of 2 to 3 Micro-Inches in Hardest Materials—Honing produces a mirror finish on material too hard to finish by other methods. Cylinders in one radial engine, with a hardness of approximately 350 on the Brinell scale, were easily finished accurately by honing.

Eliminates Future Fatigue Fracture Points—Honing eliminates future fatigue fractures by removing defects of all previous commercial operations such as tool marks, hills and valleys, grinder marks, etc., and obtains precision accuracy and any surface finish required.

Honing Landing Gear Hydraulic Cylinders and Oleo Tubes

Shown on this page are two typical installations of BARNESDRIL HONERS in the aircraft industry. Several manufacturers use a battery of BARNESDRIL HONERS for precision finishing of landing gear hydraulic cylinders. Honing results in the extreme accuracy of size and surface finish required to insure perfect fits. Other large plants use BARNESDRIL Hydraulic HONERS for finishing various styles and sizes of oleo tubes and landing gear hydraulic cylinders. Here again extremely close tolerances are required.

If you want "aircraft precision" to improve your product's performance and finish, let BARNESDRIL engineers show you how you can use honing. Send blueprints for a preliminary analysis and recommendations—there is no obligation.

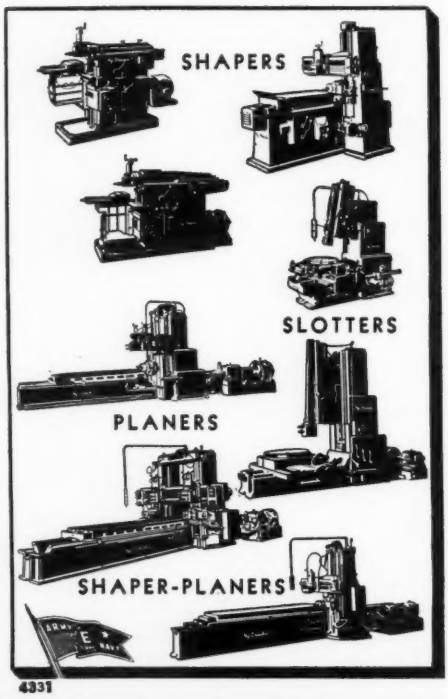
You can get complete facts about honing and our entire line of equipment in this free, valuable booklet. Write for Bulletin M-121.

Barnes Drill Co. 814 CHESTNUT STREET ROCKFORD ILLINOIS, U.S.A.

MADE IN ROCKFORD MADE MEANS PRECISION MADE... ROCKFORD ILLINOIS, U.S.A.

SHAPES, BROTHERS, SHAPES

Machined by Hy-Draulic Shapers and Planers



4331

When you must machine shapes that are neither flat, round, nor suitable for rapid machining by conventional methods; investigate the considerable possibilities in *Hy-Draulic* Shapers and Planers equipped for such jobs. Working from plaster molds, wooden models, or templates; outstanding *Hy-Draulic* features and advantages enable you to machine various forms in metal faster than by other methods. Work-pieces in lots, or in mass production, are machined likewise by duplicating suitable masters. Generated shapes of various kinds also can be produced, by different methods, on *Hy-Draulic* Machine Tools. Pictures herewith indicate some *Hy-Draulic* accomplishments. There are others, hush and hush-hush. The experience of our engineers in this field of machining is yours to command, especially on war work. Write, today, for details. Address Dept. 1507

BUY UNITED STATES WAR BONDS AND STAMPS

Hy-Draulic

Reg. U. S. Pat. Off.

Shapers..Planers..Slotters..Shaper-Planers

ROCKFORD MACHINE TOOL CO.

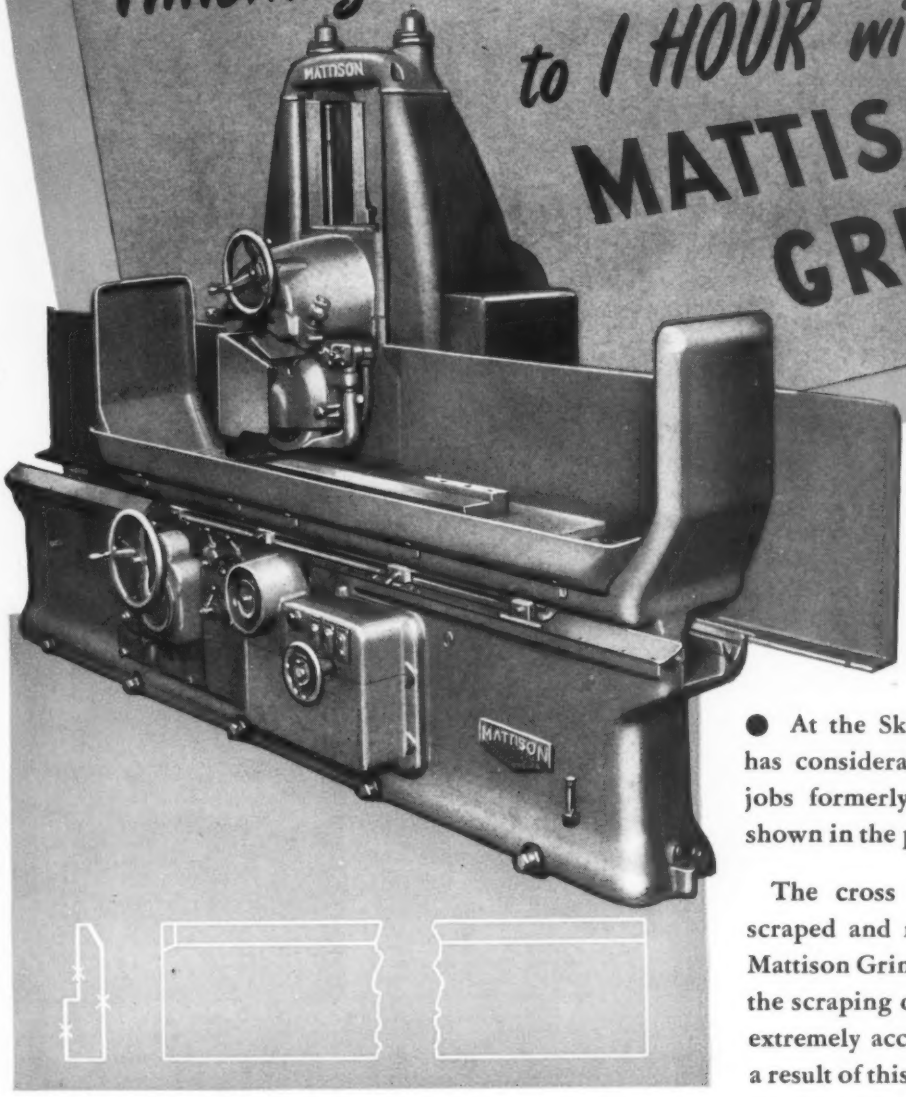
ROCKFORD, ILLINOIS, U.S.A.

MADE IN

ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS

ILLINOIS, U. S. A.

Finishing Time Cut from 6 HOURS to 1 HOUR with MATTISON GRINDER



Cross Head Guide previously hand scraped in 6 hrs. NOW GROUND in 1 hr. Greater accuracy provides additional time saving in assembly department due to better fit.

Write for free set-up book containing further examples, showing how others have reduced time and increased production with Mattison Grinders.

ASSEMBLY TIME ALSO CUT DUE TO MORE ACCURATE FIT

● At the Skinner Engine Company, grinding has considerably reduced time on a variety of jobs formerly hand scraped—One example is shown in the photo and sketch above.

The cross head guide was formerly hand scraped and required 6 hrs. Now, with their Mattison Grinder, the piece is finished in 1 hour, the scraping operation has been eliminated, and extremely accurate results obtained. In fact, as a result of this accuracy, the assembly department reports that they are also saving time due to the better fit.

In many other plants, Mattison Grinders are taking on jobs previously finished by other methods — cutting time, helping speed up production and providing fine finish and accuracy to close limits.

For further data, write for free set-up book or send in your sketch or blue print, and we will gladly furnish time estimates.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

MADE IN
FOR PRODUCTION MACHINE TOOLS IT'S... ROCKFORD
ILLINOIS, U.S.A.

ANOTHER EXAMPLE OF SAVINGS IN MACHINING TIME WITH W. F. and JOHN BARNES Unit-Type Machines

Operation ..... Drilling 9 Holes in Crank Case Intermediate Rear Part

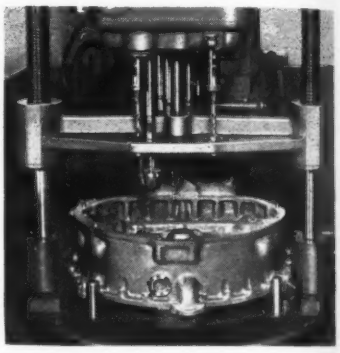
Former Machining time . . . . . 8.90 min.

W. F. & John Barnes Machining Time . . . 1.1 min.

Savings in Machining Time . . . 7.8 min.

W. F. & John Barnes 9-Spindle Vertical Unit-Type Drilling Machine for machining crankcase intermediate rear part.

● Machining time was reduced from 8.90 minutes to 1.1 minutes by combining drilling operations on one vertical W. F. & John Barnes Unit-Type Drilling Machine. The drilling of six .147″ diameter holes, two $^{19}/_{64}$″ diameter holes and one $^{13}/_{64}$″ diameter hole was formerly performed on three conventional single spindle machines at a combined time of 8.9 minutes. By simultaneously drilling 9 holes on this W. F. & John Barnes 9-Spindle Machine not only was machining time reduced but additional savings in handling time were obtained. Similar W. F. & John Barnes Unit-Type Machines perform other operations on this part.



Set-up of W. F. & John Barnes 9-Spindle Drilling Machine for drilling 9 holes in crankcase intermediate rear part.

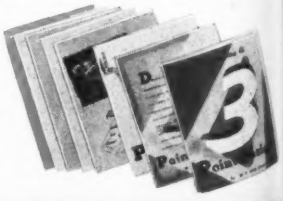
THESE FREE BOOKLETS WILL SHOW YOU HOW TO GET SIMILAR SAVINGS

SEE WHAT OTHERS HAVE DONE WITH SPECIAL MACHINE TOOLS

This set of five new bulletins will show you how W. F. & John Barnes has solved a wide variety of machining problems. Many machines, including deep hole drilling machines, unit-type special machine tools, and boring and honing machines, are illustrated and described. Write today for your free set. Ask for bulletins No. 244A.

HOW TO GET A SPECIAL MACHINE TOOL TO SUIT YOUR JOB . . . . .

This set of eight bulletins will show you how you can get a practical solution to your metal working problems with W. F. & John Barnes Special Machine Tools. Each bulletin traces a machining problem from the original study of the part to the final machine design. Write for free bulletins No. 244B.



W. F. & JOHN BARNES

W. F. and JOHN BARNES

320 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

MADE IN

ROCKFORD... MACHINE TOOL PLANTS CLOSE TO YOUR PLANT

ILLINOIS, U. S. A.

HOW TO GET THE MOST OUT OF YOUR CUTTING TOOLS

No. 5 OF A SERIES

...by selecting the proper speeds and feeds

● The following data on feeds and speeds should be considered as approximate only, since their selection for the most efficient results depends upon many conditions. We suggest that the feeds and speeds for any given job be selected from the charts below, and then varied to suit conditions listed at the right.

1. Material to be milled.
2. Stock removal.
3. Horsepower applied to the machine.
4. Accuracy and finish desired.
5. Type of cutter.
6. Rigidity of the work to be milled.
7. Type of cutter set-up.
8. Type of work holding fixture.

Cutting speed, or the peripheral speed of the cutter, depends primarily upon the material being milled.

GUIDE TO CORRECT SPEED SELECTION

To determine the proper R.P.M. for a given size cutter, assume a cutting speed from the following table and then calculate the speed. The R. P. M. of a cutter can be easily figured from this simple formula:

Material	Cutting Speed in Feet Per Minute	
	Rough Milling	Finish Milling
Cast Iron — good grade	65 to 75	80 to 95
Malleable iron	75 to 85	85 to 105
Mild steel	75 to 85	85 to 105
High carbon steel	45 to 50	50 to 55
Alloy steel	40 to 55	55 to 75
Brass	95 to 105	105 to 190
Aluminum	500 to 700	700 to 1000

$$\text{R. P. M.} = \frac{3.82 \times \text{cutting speed (from chart)}}{\text{Diameter of cutter}}$$

GUIDE TO CORRECT FEED SELECTION

The speed and feed finally selected should be such that each cutter tooth will have the proper chip load. Frequently poor milling conditions result when the chip per tooth is too small, and sometimes cutter breakage occurs when the chip per tooth is too large.

In general, select the proper speed for the work, material and cutter as suggested above, and then determine the feed, within the limits given, according to the cut and the power available or the finish required. Using the following formula for the chip load given in the chart below, the feed can then be easily calculated.

Feed = Chip load x number of teeth x R.P.M. of cutter.

RECOMMENDED CHIP LOAD TABLES

Type of cutter	In Cast Iron	In Steel	In Brass Bronze Aluminum
Face Mill	.020 to .025	Less 40%	Plus 50%
Shell End Mill	.007 to .011	Less 40%	Plus 50%
Spiral End Mill	.001 to .008	Less 40%	Plus 50%
Slotting Cutter	.006 to .012	Less 40%	Plus 50%
Saw	.001 to .003	Less 40%	Plus 50%
Spiral Mill	.010 to .015	Less 40%	Plus 50%
Form Mill	.004 to .006	Less 40%	Plus 50%
Cemented Carbide Face Mill	.008 to .012	.004 to .008	.010 to .016

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THIS TOOL CONSERVATION MESSAGE FROM **Barber-Colman Company**

GENERAL OFFICES AND PLANT • 109 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

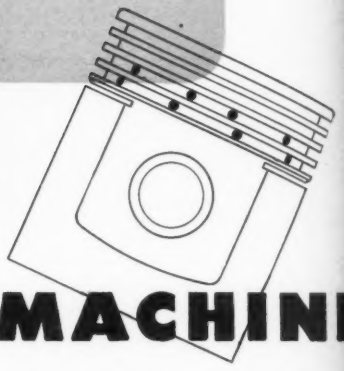
MANUFACTURERS OF HOBS, CUTTERS, REAMERS, HOBBING MACHINES, SHARPENING MACHINES

MADE IN

FOR METAL REMOVAL WITH ACCURACY AND SPEED... **ROCKFORD**

ILLINOIS, U. S. A.

Rehnberg-Jacobson



PISTON SMOKE HOLE MACHINE

DRILLS 18 HOLES

NINE No. 1 UNITS

EXCELLENT EXAMPLE OF LOW COST AND FLEXIBILITY...

There are 10 1/8" smoke holes to be drilled in the third groove and 8 similar holes in the fourth groove of this aluminum piston which is 3.226" in diameter and 3 11/16" long. The special Rehnberg-Jacobson machine shown here does this job at the rate of 300 pistons per hour. The piston, with a rod through the wrist pin holes, is placed in the center fixture and clamped. The nine Rehnberg No. 1 Drill Units, each controlled by a built-in cam, advance and complete a cycle to produce 5 holes in the third groove and 4 in the fourth. The piston is released, raised and turned 180 degrees, and clamped back in position, whereupon the drilling cycle is repeated to complete the 18 holes. Note the simplicity and effectiveness of this machine, especially the circular T-slot mounting of the units which enhances the flexibility and salvage value. (Outboard braking units shown are, in later models, incorporated in the motor housing.) This is an excellent, but not exceptional, example of how our units can be disposed on a simple structure to produce an efficient production machine. *Can't we provide something along the same line for you?*

REHNBERG R-J JACOBSON

REHNBERG-JACOBSON MANUFACTURING CO.

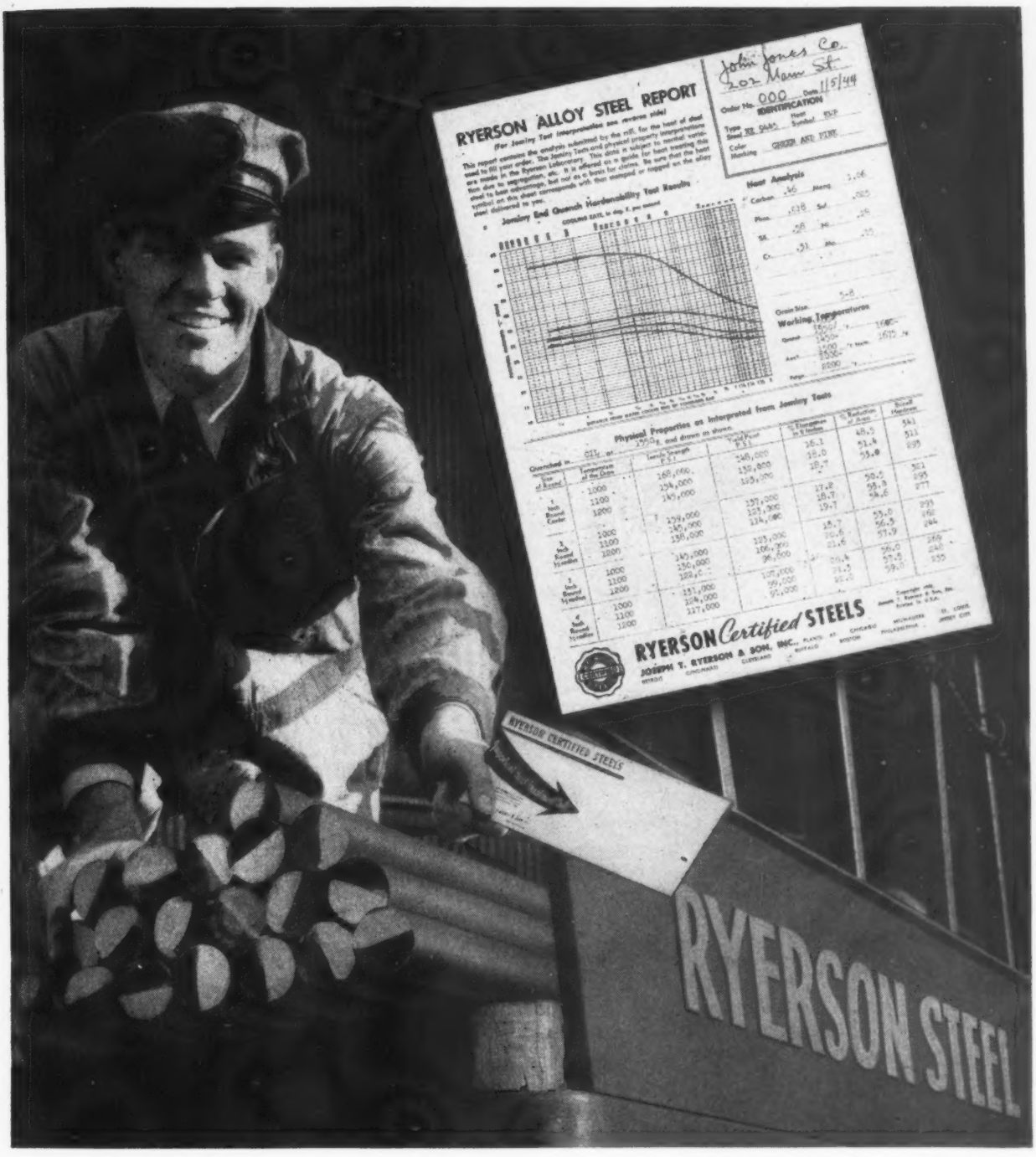
Special Machinery

2137 MISHWAUKEE ST. ROCKFORD, ILLINOIS

MADE IN

ROCKFORD... A CONVENIENT SOURCE FOR PRODUCTION NEEDS

ILLINOIS, U. S. A.



New Data With Alloy Shipments

When you buy alloy steel from Ryerson you receive helpful information on the heat-treating characteristics of the steel with each shipment. This time and money-saving information is included in the individualized Ryerson Alloy Steel Report which gives you more complete data than has ever before been furnished with steels shipped from stock.

A separate report sheet is supplied for each heat, and all heats are easily identified through color markings and heat symbols.

From large and complete alloy steel stocks at Ryerson you can select the steel best suited to your needs. A wide range of analyses and sizes in carburizing, medium hardening and high hardening grades are available in hot rolled, cold finished and heat-treated form.

Call your nearby Ryerson Plant for quick action on steels of any kind . . . and for a special service on alloys.

JOSEPH T. RYERSON & SON, INC.

Steel Service Plants at: Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

Magic Carpets That Conquer Time and Mud

U.S. Army Signal Corps Photo

THIS bomber has just landed on a field that a short time before was ankle-deep in mud. Portable steel mats made it possible . . . strong interlocking strips of tough copper-bearing steel which are quickly laid, creating a hard-surfaced runway for take-offs or a landing field capable of withstanding the impact of a Flying Fortress.

Here's How Oakite Materials and Methods Help Turn Out Miles of Landing Mats

Huge presses punch out these magic carpets from heavy gauge sheet steel . . . a difficult job made easier by a special Oakite lubricant. Automatic washing machines degrease the mat components with a fast-working Oakite detergent that completely removes oils, dirt and carbon from channels and grooves, quickly preparing surfaces for application of Army-green zinc chromate paint which adheres with a bull-dog grip.

Put Oakite Service to Work in Your Plant!

Whether on landing mats or a thousand and one other essential war supply items, Oakite Technical Service Representatives, backed by 36 years' experience, are helping war plants achieve smooth-running production at uniformly low cost. Let us do the same for you. Inquiries on hard-to-solve cleaning problems invited. Won't you write us today?

Manufactured only by

OAKITE PRODUCTS, INC., 26 Thames Street, NEW YORK 6, N.Y.

Technical Service Representatives in All Principal Cities of the United States and Canada

Typical War Supplies on Which Oakite Materials And Methods Are Used!

Airplanes	Howitzers
Motors	Motorcycles
Powder Boxes	Tanks
Shells	Helmets
Shell Cases	Adaptors
Bomb Cases	Primers
Incendiaries	Cartridges
Grenades	Depth Bombs
Land Mines	Torpedo Parts
Rifles	Gun Mounts
Gun Parts	Revolvers
Trench Mortars	Tank Treads

OAKITE CLEANING

MATERIALS...METHODS...SERVICE — FOR EVERY CLEANING REQUIREMENT

DOW magnesium

THE METAL OF MOTION

Pouring Magnes... operations extend... tion of ingots to fa... finished products from Magnesium Alloys.

TO SPEED THE JOB . . .

MAGNESIUM OPENS NEW OPPORTUNITIES TO LIGHTEN THE LOAD AND INCREASE EFFICIENCY

All America is alert to the great promises of tomorrow. These are the alluring rewards of victory—a new, faster-moving, more efficient America.

Magnesium—that incredibly light yet strong, durable metal—synchronizes with this new, speedier era.

Magnesium is the metal of motion! Wherever lightness means less manual fatigue — faster transportation — higher speeds with less power—magnesium is in the designer's mind. You will come to know magnesium as you know iron, steel, copper, lead, zinc and aluminum. It is a basic metal—"new" only in terms of large-scale production and our growing knowledge of how to cast, weld, forge, extrude and machine it.

Magnesium is ready, when the war is won, to take its place in a faster-moving industrial America.

MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

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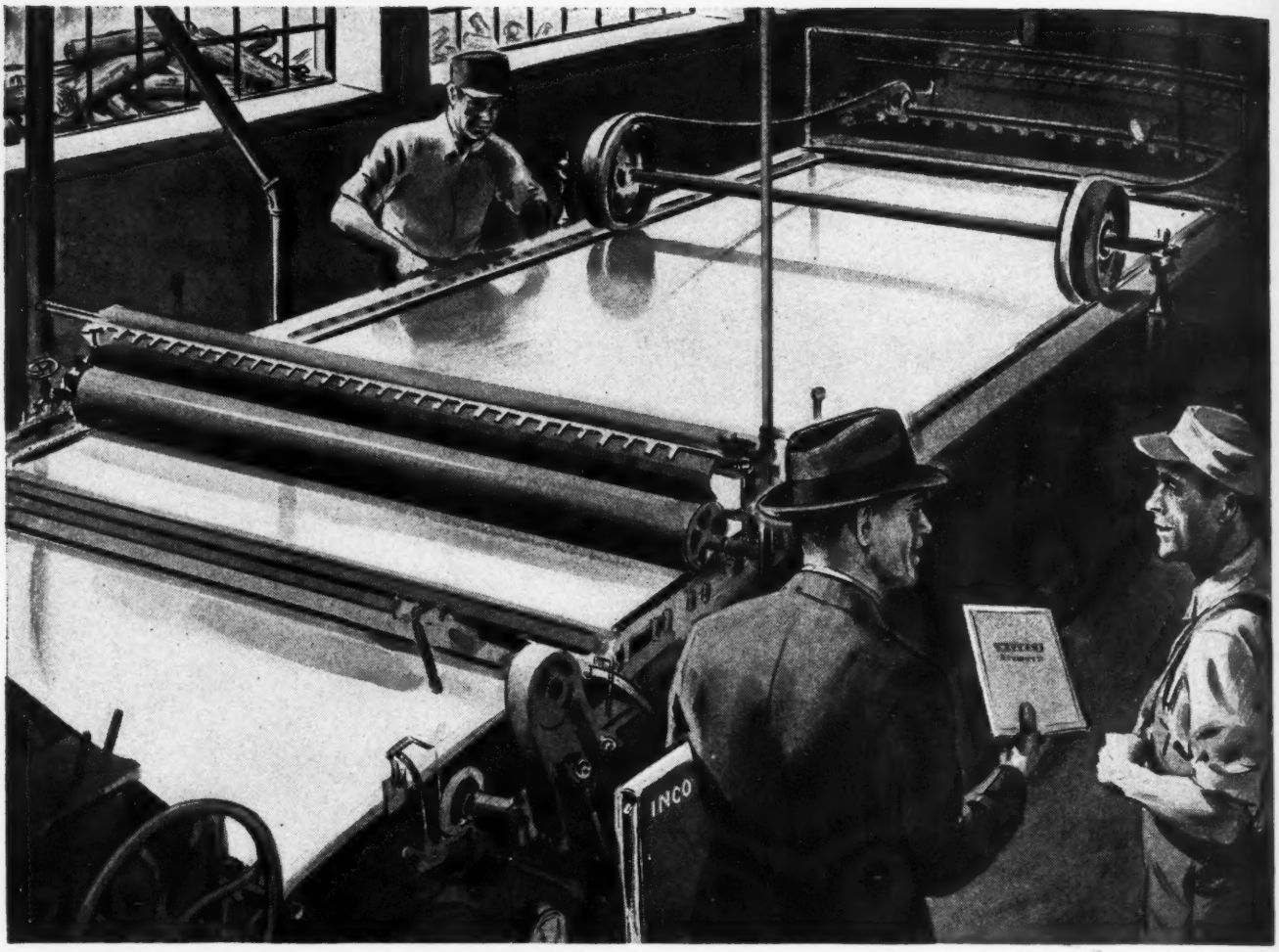


NICKEL AIDS THE PAPER AND PULP INDUSTRY

to KEEP 'EM PRODUCING!

"Paper is one of the sinews of war" . . .

A basic tool of communication . . . strategic substitute for metal in many products.

Made, for example, into new export containers that protect their contents against water, vapor, and grease, it's a vital factor in the Battle of Supply.

So the need is tremendous . . .

And the industry's vast output is possible largely because paper-making is almost entirely a machine process.

Plant engineers agree that when you depend so much on machinery, you'd better have machines that are dependable.

That is why . . . thanks to those engineers and the machine designers . . . equipment in paper and pulp mills includes large amounts of Nickel alloyed materials.

Metals so fortified help a lot to keep machines producing, because Nickel imparts toughness . . . strength . . . corrosion resistance.

Thus, when properly used in critical parts, "a little Nickel goes a long way" toward increasing dependability.

From grinder cylinders to dryer rolls, from digesters and save-all pans to Fourdrinier rails and beams, Nickel alloyed parts stand up better to abrasion, wear, and corrosive chemicals.

We have long enjoyed the privilege of cooperating with technical men interested in the selection, fabrication, and heat treatment of metals . . . not only in the paper industry but in many others. Whatever *your* industry may be . . . if you'd like to have such assistance . . . counsel and printed data are available on request.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects — from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

★ *Nickel* ★

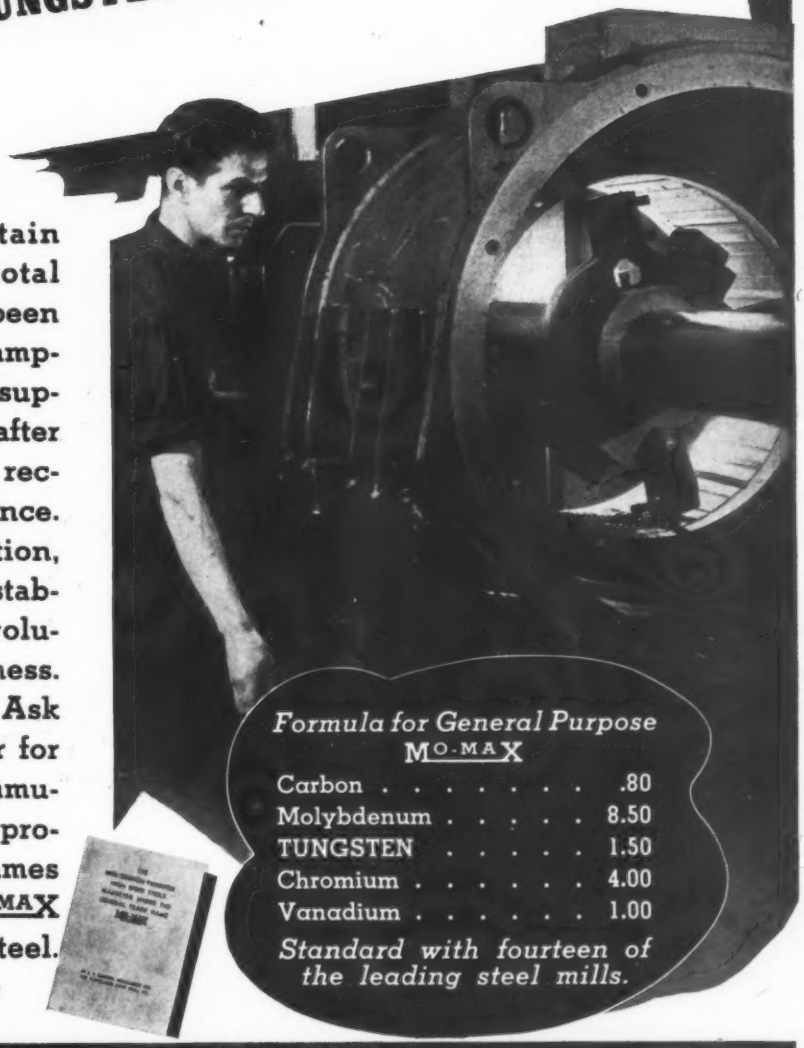
THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

Restrictions are off

MO-MAX

TRADE MARK REG. U.S. PAT. OFF.

MOLYBDENUM-TUNGSTEN HIGH SPEED STEEL



The war-born shortages in certain materials, which restricted the total possible output of MO-MAX, have been overcome. No longer need you be hampered by inability to obtain adequate supplies of MO-MAX. Today, MO-MAX, after ten years of successful use has a record of tested and known performance.

For quality and quantity production, STANDARDIZE on thoroughly established MO-MAX, the steel that revolutionized the high speed steel business. It is available from reliable sources. Ask your nearest regular steel supplier for MO-MAX. If it is not in stock, communicate with any of the tool steel producers listed below. Their brand names shown on this page are all MO-MAX molybdenum tungsten high speed steel.

Formula for General Purpose MO-MAX

Carbon	.80
Molybdenum	8.50
TUNGSTEN	1.50
Chromium	4.00
Vanadium	1.00

Standard with fourteen of the leading steel mills.

For technical data booklet, write any mill named or The Cleveland Twist Drill Co., Cleveland, Ohio.

THEY'RE ALL MO-MAX

"LMW"	Allegany Ludlum Steel Co.	"Molite 8"	Columbia Tool Steel Company	"Tatmo"	Latrobe Electric Steel Co.
"Mohican"	Atlas Steels, Ltd.	"Rex-T-Mo"	Crucible Steel Co. of America	"S.T.M."	Simonds Saw and Steel Co.
"Bethlehem HM"	Bethlehem Steel Company	"Di-Mol"	Henry Disston & Sons, Inc.	"Mo-Tung"	Universal-Cyclops Steel Corp.
"Mo-Cut"	Braeburn Alloy Steel Corp.	"Rex-T-Mo"	Halcomb Steel Co.	"Vul-Mo"	Vulcan Crucible Steel Co.
"Star Max"	Carpenter Steel Co.	"Mogul"	Jessop Steel Company		

4814

2 things

shopmen tell us about Bethlehem Carbon Tool Steels

Right through the war emergency shopmen have been turning in enthusiastic reports about the service they're getting from Bethlehem Carbon Tool Steels. They praise these steels chiefly on two counts:

Ease in machining

Minimum distortion under heat-treatment

We've had a lot of shopmen tell us this, by letter and by word of mouth. We'd rather have a good word about tool steel from a shopman than from anybody else, for he's the man who *knows*. He's working with the steel every hour of every day. When he says tool steel is good, *it's good.*

If work in your shop requires carbon tool steel, try Bethlehem Carbon Tool Steels. We think you'll like them.

BUY MORE WAR BONDS

★ BETHLEHEM STEEL ★

Official U. S. Army Signal Corps Photo

THERE'S A *New* HEAVY WEAPON ON THE CUTTING LINES, TOO - IT'S *Super DBL* HIGH SPEED STEEL

Available

IN THESE FORMS

★ Hot Rolled and Forged Bars in all necessary sizes.

★ Ground Bars: rounds in sizes up to 3" dia.—polished, standard ground or rough ground finishes.

★ Hardened and Tempered Tool-Holder Bits in sizes from 3/16" to 1", packed in one or assorted sizes as needed. Also special sizes as may be required.

NOTHING NEW TO LEARN IN HEAT TREATMENT OR SHOP HANDLING

IN the M-12 Tank Destroyer, above, Army Ordnance has combined the great hitting power and range of the 155 mm gun with the speed and mobility of the medium tank chassis. The result is a weapon that not only can stop any enemy tank now or likely to be in the field, but can blast out land strong-points or sink a ship.

In similar fashion, Allegheny Ludlum technicians have added cobalt to the familiar AL-developed DBL low-tungsten moly analysis. The result, *Super DBL,* is a high speed steel of maximum red hardness for heavy duty work—a material that delivers top performance at the same time that it conserves strategic materials.

Super DBL has been thoroughly proved in service. Use it for your heavy roughing and "hogging" jobs—it's suitable for anything from hard, gritty materials to tough, heat-treated alloy steels. ● Full information is available in the *"Super DBL* Blue Sheet." Write for your copy, or for the assistance of our Mill Service Staff in selecting the proper grades of AL Tool Steels for your various production jobs.

ADDRESS DEPT. M-20

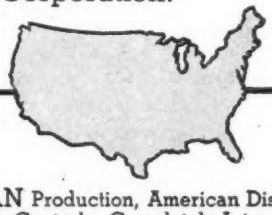
Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-9075 ... W & D

Tungsten high-speed steel can now be made and used as needed. With minor exceptions, restriction is off. A better balance between need and supply has made this possible.

So resourceful have been our metallurgists and plant production men, and so fortunate our access to alternative materials, that during the months when Tungsten was scarce, our output of high-quality steels was not greatly impaired. But now that Tungsten is again obtainable, many manufacturers are returning to it for uses in which it has long been the standard material.

Inquiries concerning the availability or the metallurgical behavior of Tungsten, Molybdenum, or Boron will be welcomed by the Molybdenum Corporation.



AMERICAN Production, American Distribution, American Control—Completely Integrated.
Offices: Pittsburgh, New York, Chicago, Detroit, Los Angeles, San Francisco, Seattle.
Sales Representatives: Edgar L. Fink, Detroit; H. C. Donaldson & Co., Los Angeles, San Francisco, Seattle.

MOLYBDENUM CORPORATION OF AMERICA
GRANT BUILDING · PITTSBURGH, PA.

MCA

Reduce Replacement Costs

by Hard-Facing with Haynes Stellite Rods

THE life of wearing parts of industrial machines and equipment can in many cases be increased from 2 to 25 times by hard-facing with Haynes Stellite rods.

Hard-Face All Parts—Old and New

Old parts which are badly worn can often be reclaimed and armored against wear by applying Haynes Stellite rods. To assure maximum savings, it usually pays to hard-face new parts—*before* wear occurs. Then when long use finally does impair their efficiency, most parts can be hard-faced again and again for added service.

Other Advantages of Hard-Facing

The use of Haynes Stellite hard-facing materials frequently permits use of cheaper base metals—or makes possible the use of a readily available substitute base metal when the usual kind cannot be obtained. When cutting or scraping edges are hard-faced, they stay sharp longer, often reducing power consumption. Time out for repairs is cut down by hard-facing, and this helps maintain high production schedules. At the same time, hard-facing decreases maintenance work and solves many replacement problems.

Wherever abrasion . . . impact . . . heat . . . or corrosion . . . are encountered, there's a Haynes Stellite rod to furnish lasting protection. Write for a descriptive price list.

A Rod for Every Purpose

Stellite Rod – the original non-ferrous cobalt-chromium-tungsten hard-facing alloy —now available in three different grades— high in "red hardness," highly resistant to abrasion and corrosion—applied by oxy-acetylene or electric-arc process.

Hascrome Rod—iron-base hard-facing rod containing chromium and manganese — work-hardens under impact – applied by oxy-acetylene or electric-arc process.

Stellite "93" Rod – iron-base hard-facing alloy containing more than 40 per cent of alloy ingredients – hard and abrasion-resistant – applied by oxy-acetylene or electric-arc process.

Haystellite Inserts—cast tungsten carbide in 13 standard shapes and sizes—extremely resistant to abrasion—generally applied by oxy-acetylene process with high-strength steel rod as binder.

Haystellite Tube Rod—tungsten carbide grains of 9 standard screen sizes in high-strength steel tubes—extremely wear-resistant—applied as hard-facing rod, generally by oxy-acetylene process.

Haystellite Composite Rod—tungsten carbide grains of 4 standard screen sizes uniformly distributed in high-strength steel binder – extremely wear-resistant – applied as hard-facing rod, generally by oxy-acetylene process.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York 17, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

"Stellite," "Haystellite" and "Hascrome" are registered trade-marks of Haynes Stellite Company.

LATROBE

TUNGSTEN HIGH-SPEED *Steels*

LATROBE offers a complete series of straight tungsten high speed steels, each of which is the product of rigidly controlled metallurgical processes, resulting in the finest quality steels obtainable in their field. They differ primarily in vanadium content, thus giving you a choice of steels for varied production requirements.

ELECTRITE No. 1

Electrite No. 1
A general purpose tungsten high speed steel, (1% Vanadium) for use where maximum toughness is desired.

ELECTRITE No. 19

Electrite No. 19
A tungsten high speed steel with 2% Vanadium for greater wear resistance and improved production.

ELECTRITE *Vanadium*

Electrite Vanadium
The latest development in tungsten high-speed steels containing over 3% Vanadium and affording maximum wear-resistance.

LESCO

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT · · LATROBE · PENNSYLVANIA

ONE WORD

6 doz. HACK SAW BLADES Made of *Ingersoll* D-B-L STEEL

INGERSOLL D-B-L

(Tungsten . . . . . 5.00-6.00)
(Molybdenum . . 4.00-5.00)

The remarkable performance of Ingersoll D-B-L . . . its relative freedom from decarburization . . . its tough cutting quality and its high impact resistance . . . plus its lower cost, have made it a wartime favorite.

Only INGERSOLL has had 4 YEARS EXPERIENCE

in producing this Lower Cost Type of High Speed Steel for Hack Saw Blades

Specify *Ingersoll* D-B-L, on its 4-year record of past performance.

INGERSOLL SPECIAL STEELS *FOR SPECIAL USES*

Alloy Steels
Armor Plate
Clutch Plate Steels

Tillage Steels
Soft Center Steels
Shovel Steels

Knife Steels
TEM-CROSS Steel
IngAclad (Stainless-Clad Steel)

Stainless Steels and Saw Steels, including "18-4-1" and Molybdenum and D-B-L Hack Saw Steels

JOHNSON BRONZE

SLEEVE TYPE BEARINGS

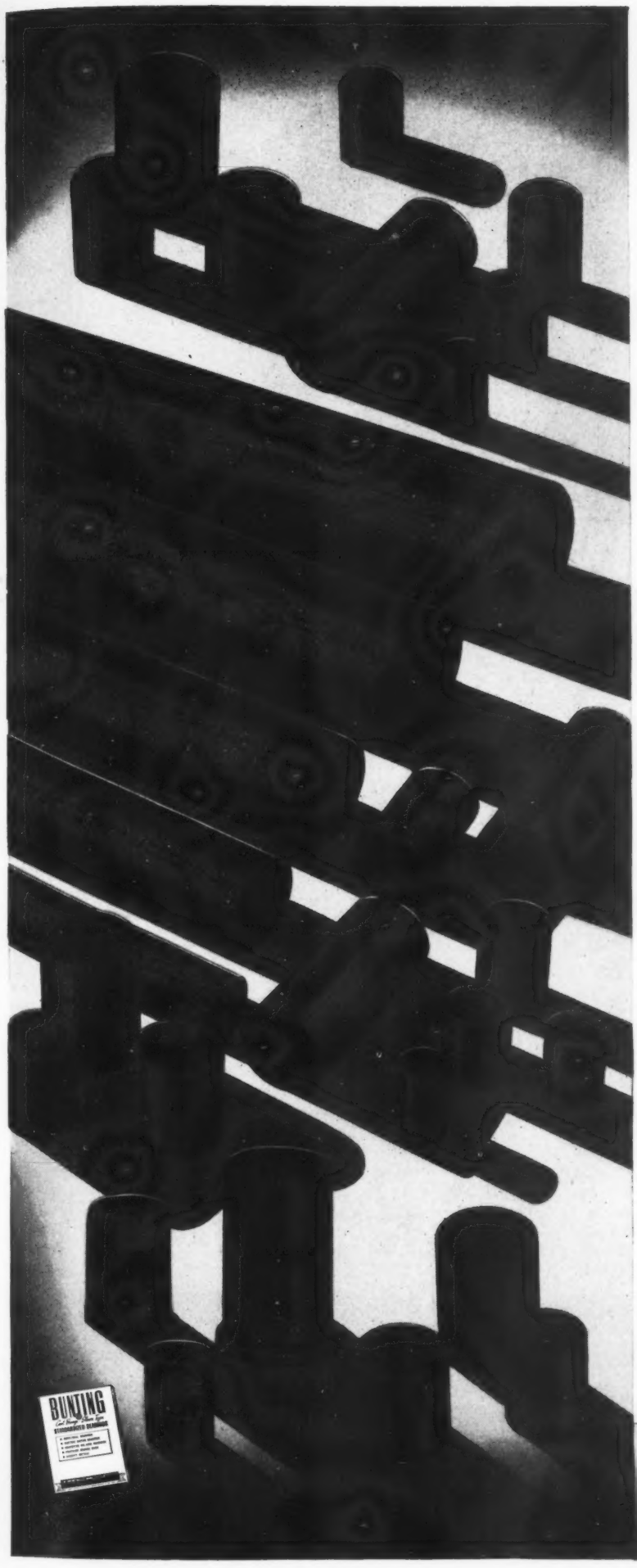
Ready to use...

Johnson General Purpose Bearings save precious time in many ways. When you place your order you have over 800 sizes to choose from. This enables you to buy exactly according to your needs. Every General Purpose Bearing is completely machined inside—outside and ends. Thus they are ready for immediate installation. There is no extra machining . . . no cutting down . . . no excess stock to remove. Oil grooving slots or holes are easily, quickly and economically added when necessary.

When properly installed, Johnson General Purpose Bearings will deliver a maximum of service with a minimum of attention. The next time you need plain, cast bronze bearings—call in your local Johnson Distributor. Permit him to show you how to save both time and money . . . how to avoid waste and delay by specifying Johnson General Purpose Bearings.

NEW
Catalogue
72 pages...lists and describes the most complete sleeve bearing service in the world. Write for your copy...TODAY.

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
520 S. MILL STREET NEW CASTLE, PA.
The MOST COMPLETE SLEEVE BEARING SERVICE in the WORLD



Bearing Bronze In Its Most Usable Forms....

● Bunting Bronze Standardized Bearings come to you completely machined and finished to the stated size and tolerances. They are made with absolute accuracy in all dimensions and with perfect concentricity, entailing no further expenditure of labor and time for such operations in assembly. They fit practically all applications in machine tools, electric motors and general industrial machinery. They are readily adapted to other and unusual requirements.

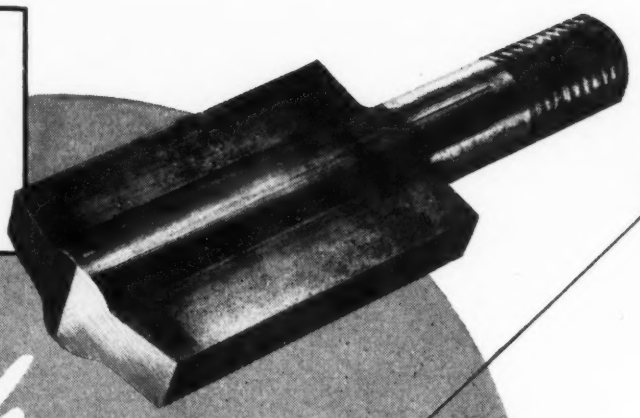
Factory finishing of Bunting Bearing Bronze Bars saves you about 25% of purchased metal as compared with rough cast bars and about 50% of machining time, and keeps valuable scrap where it can be most economically utilized. This economy is passed on to the user.

Ask your local wholesaler. Write for catalog of Bunting Bronze Bearings and Bars. Provide these items in the most modern and efficient forms for all machinery production and maintenance. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in Principal Cities.

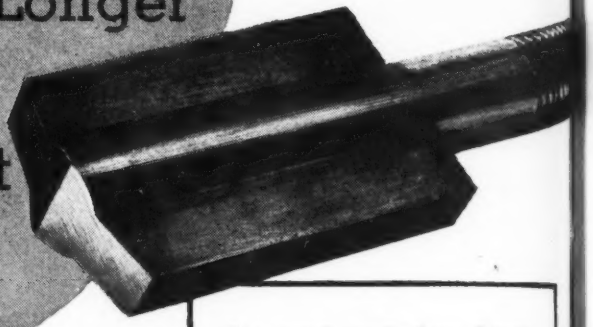
Bunting

BRONZE BUSHINGS • BEARINGS • PRECISION BRONZE BARS

This tool for punching 3/16" thick O.H. steel sheet was made from a tool steel that promised to provide the *toughness* needed on the job. But excessive wear meant that the punch had to be reground after 190,000 holes had been punched.



Which OF THESE TWO TOOLS Will Stay On The Job Longer and Increase Machine Output Per Month?



This punch made from *Stentor* tool steel provided just the right combination of toughness and wear resistance for the job. With it, production jumped over 100% —to 387,000 holes between grinds!

here is WHY one tool does a better job...

Good tool steel is only *one* of the answers to getting tools that stay on the job longer.

But to get best possible results, you need more than that.

A tool giving 100% more production isn't just a stroke of luck! The tool room foreman knew what he needed for the job. He had found a *definite system* for picking the one tool steel that would do the job best. And as the heat treater had complete, easy-to-use instructions, they got real results right off the bat!

You can do the very same thing, by simply following the steps on the opposite page. Carpenter can give you a *definite system* for quickly finding the right tool steel for each job. You'll save time and have fewer tools to make. And when you put Carpenter's heat treating information to work on your jobs, watch the headaches disappear.

To find the road that leads the way to better tools, more output from each machine and press, follow the steps on the opposite page.

THE CARPENTER STEEL COMPANY • 105 W. Bern St., Reading, Pa.

Carpenter **MATCHED TOOL STEELS**

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

Follow these steps

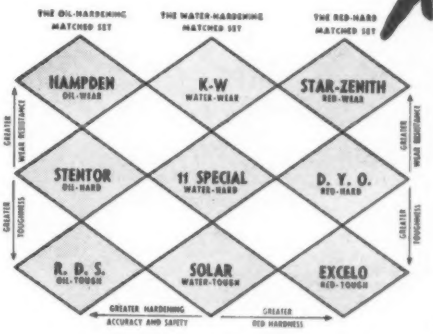
TO GET LONGER TOOL LIFE!

1 *Get acquainted* with the Matched Set Diagram

It actually points to the tool steel properties you need for almost every type of job in your tool room.

For example, you always start with the center diamond, *No. 11 Special* (water-hard) straight carbon tough timbre tool steel. But when you want greater *wear resistance,* you travel *north* on the diagram. For greater *toughness,* you go *south*. For *red-hardness,* go *east.* And for greater *hardening accuracy* and *safety,* the diagram points to the *west.*

Each of the *Matched Tool Steels* on the diagram picks up its job where another leaves off. So you know in advance just what results to expect.



2 *Ask for a copy of* this Tool Steel Manual

It carries the *Matched Set Diagram* one step further.

In addition to helping you get the most from the diagram, this Manual contains an 80-page *Tool Index and Steel Selector.* Just flick the indexed pages to find the tool steel recommended for any one of more than 200 types of tools! And the *Carpenter Matched Tool Steel Manual* is saving time in heat treating departments, too. It gives complete, simplified heat treating instructions that protect the hours of skilled labor that go into tool making.

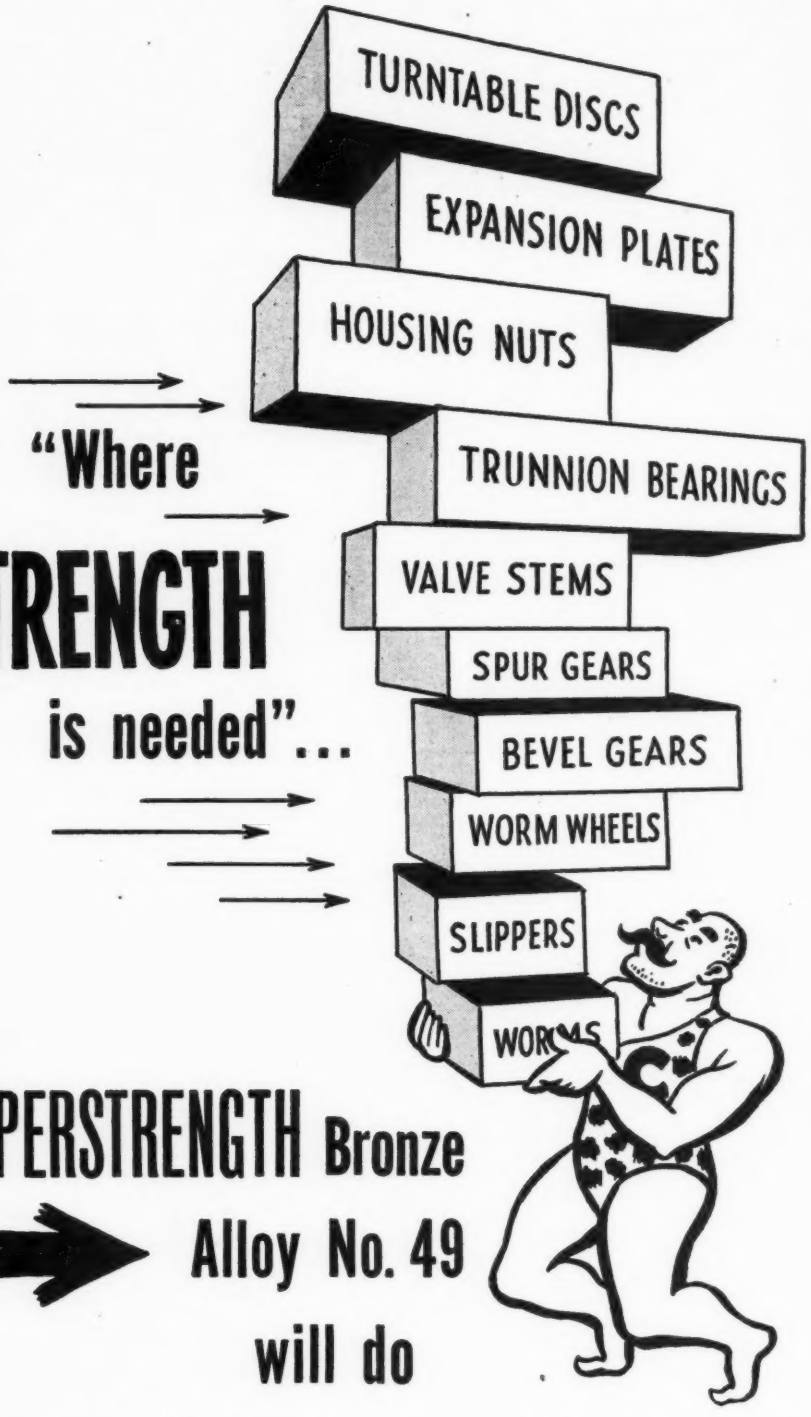
For your free copy of the *Matched Tool Steel Manual,* just drop us a note on your company letterhead.

3 *Make use of* this Tool Steel Experience

In your tool room, heat treating department or production shop—here is another way to help get the most from every pound of tool steel you use.

Get in touch with your nearby Carpenter representative and let him put his diversified experience to work for you. He knows tool steel inside and out, and can offer practical suggestions that get problems licked faster. Get in touch with him about that trouble-shooting job of yours, and he will help you get started on the Matched Set Method.

The Standard Tool Steels of Industry



"Where SUPERSTRENGTH is needed"...

Only Cramp SUPERSTRENGTH Bronze Alloy No. 49 will do

Cramp Superstrength Bronze is a special alloy which contains no tin. It is 7% lighter than Phosphor Bronze. No heat treatment is required to obtain the physical properties given above. Superstrength Bronze is available in four grades, in cast, rolled or forged form . . . is readily machined and takes a high polish in any grade.

Superstrength Bronze is recommended for heavy duty, slow moving loads where the contact speed does not exceed 270 linear feet per minute.

BLW THE BALDWIN GROUP

CRAMP

BRASS AND IRON FOUNDRIES

DIVISION OF THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

DISTRICT OFFICES: NEW YORK, SAN FRANCISCO, CLEVELAND, NEW ORLEANS

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STANDARD

for measurements ranging from 5/8" to 1" with UX Indicator graduated in .0001"

Fast, Light, Accurate...

HERE'S the newest addition to the STANDARD family of Dial Bore Gages. A small, lightweight, fast, close-tolerance checking instrument for small bores comparable in accuracy with the larger size dial bore gages.

Utilizing the same centralizing principle of other STANDARD Dial Bore Gages, it is only necessary to insert the gage, and rock handle slightly. Minimum reading on indicator shows exact diameter. Even holes with obstructions such as shoulders, webs, undercuts. etc., can be measured because this Dial Bore Gage can measure within ¼" from the bottom of blind bores. Operation is reduced to a minimum; accuracy and precision assured; and the range of workability is considerably increased as a result of improved design.

Other Dial Bore Gages with measuring range to 12⅛" completely illustrated and detailed in our new No. 10 Catalog. Send for it.

STANDARD

Dial Snap Gage

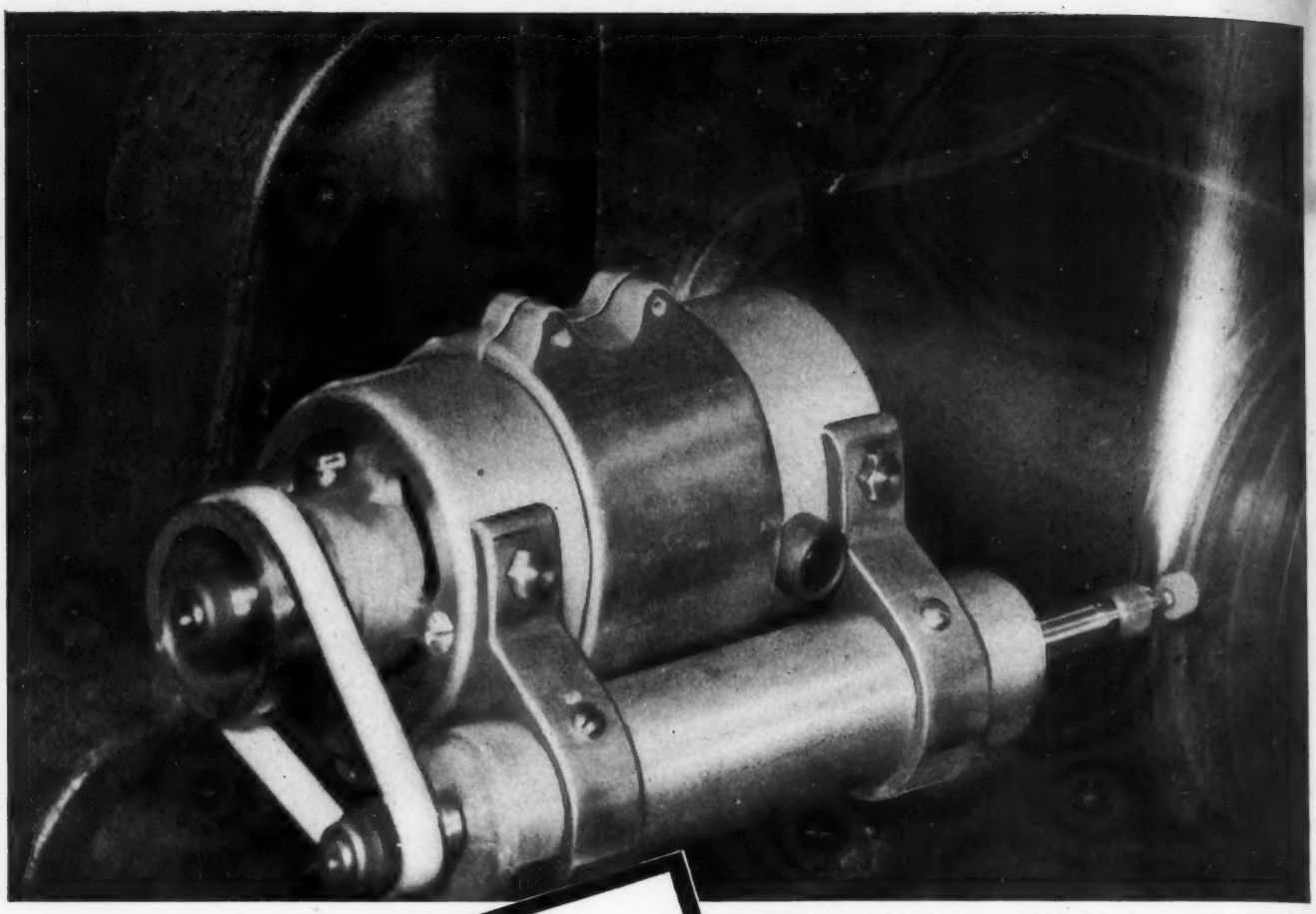
STANDARD Dial Snap Gages combine PORTABILITY with speed in use and absolute accuracy on dimensions as fine as .0001". Adjustable gaging pin has a serrated flat surface tipped with tungsten carbide that practically defies wear. Opposite movable pin has mushroom top, also tungsten carbide. Point-and-plane construction assures continued, accurate readings whether instrument is set by cylindrical or flat standards.

16 Stock Sizes cover Range 0" to 8". Each can be set to measure any dimension within a range of ½". Sizes measuring up to 4" designed as at right. Sizes 4" to 8", because of larger size, are made with convenient finger hole grip for greater ease in handling.

Write for Special Bulletin on STANDARD Dial Snap Gages.

ARMY (E) NAVY

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.



● Themac high speed, portable, electric, precision grinder
Built by THE McGONEGAL MANUFACTURING CO.

40,000 r.p.m. on precise bearings

SKF

BALL AND ROLLER BEARINGS

There's no need to worry about bearing trouble on metal removing jobs where this Themac Precision Grinder works. When the spindle turns at 40,000 r.p.m., four SKF Deep Groove Ball Bearings – two on the spindle and two on the motor – easily take combined radial and thrust loads.

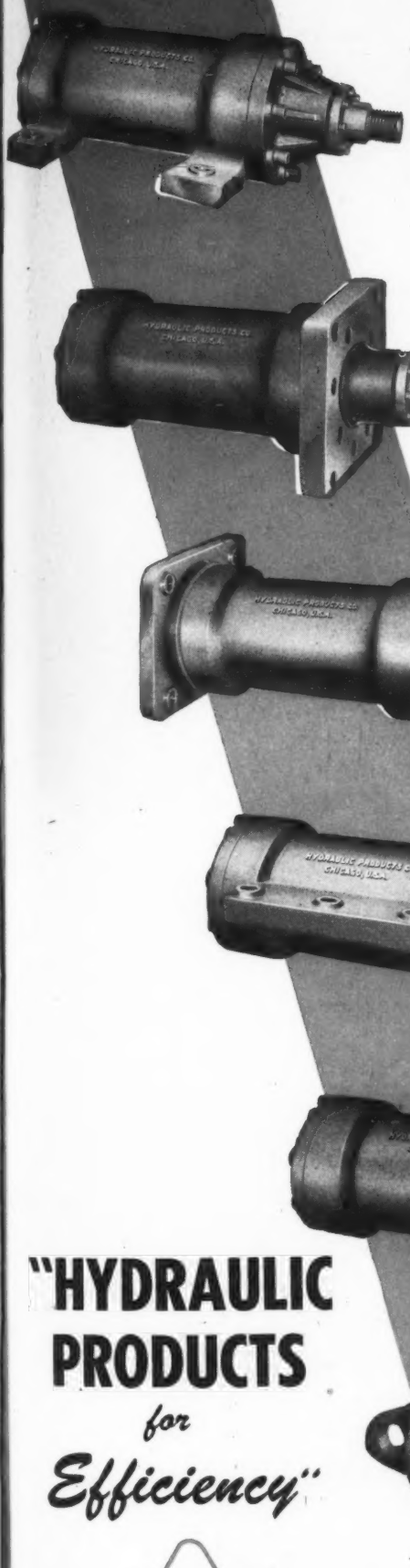
Deep, uninterrupted symmetrical races and a groove curvature closely conforming to the balls enable SKF Deep Groove Ball Bearings to have large contact areas. In addition, they're made of through-hardened materials to exactingly close tolerances by workmen skilled in precision. Bring these advantages to a Themac grinder, and you have an ideal combination for fast, accurate war work. 5457

SKF INDUSTRIES, INC. • FRONT ST. & ERIE AVE. • PHILADELPHIA 34, PA.

Here are the facts about

HYDRAULIC CYLINDERS

THAT ARE SPEEDING WAR PRODUCTION!



In many busy war plants turning out parts and equipment for our fighting forces abroad, Hydraulic Cylinders bearing the "Hydraulic Products Company" trade mark are helping step up output by providing a uniform, dependable flow of power for operating a variety of movements required in the functioning of industrial equipment. Through suitable Control Valves and Relief Valves also made by "Hydraulic", an infinite range of changes in the rate of movement can be obtained, the Valves providing for the automatic changes in rate and direction of movement at different steps until the cycle is completed.

You may find the answer to a vexing production problem in the new bulletin—just published—giving interesting facts about our complete line of HYDRAULIC CYLINDERS. Some of these cylinders (with various mountings for different types of applications) are shown at the left. The bulletin gives blueprint diagrams of each, together with full data.

"HYDRAULIC PRODUCTS *for* *Efficiency*"

A large part of our plant capacity is assigned to war work. But so far as possible, we are keeping our regular products available for your use. Bulletins set forth engineering data and details. Write.

HYDRAULIC PNEUMATIC TRADE MARK MACHINERY

HYDRAULIC PRODUCTS CO.

525 W. 76 TH ST., CHICAGO, ILL., U.S.A.

ENDABLE...

...so are Morse Tools

That's Why Morse Tools help to increase production.

Tools are Weapons
—Treat 'em Right!

MORSE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

YOUR new product for postwar may be "back of the screen" or out in the open—in blueprints on the board or working models under test. Or, the "new products" may be your former lines brought up-to-date. Whatever your plans, you can be sure of this:

The lower your buying costs, the lower will be your producing costs. And in peacetime just as now you will *keep on* saving money by purchasing from your ◆ Industrial Supply Distributor—using him as your central source for all materials and parts, instead of scattering your orders among the manufacturers.

Today *and* tomorrow—before you order Cle-Forge High Speed Drills, Peerless High Speed Reamers, or other supplies—check with your Industrial Supply Distributor.

He probably can send what you need from stock—or already has it coming in. It saves your time—it helps keep your production rolling at top schedules—to

Telephone your ◆ I S D ◆ FIRST!

◆ C ◆

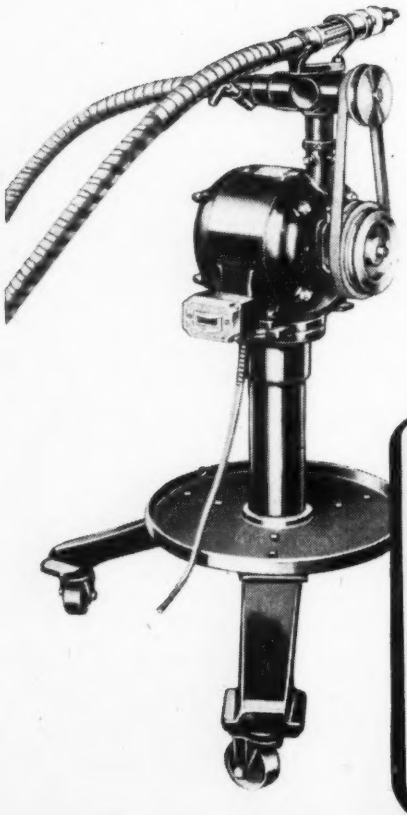
ARMY NAVY — ARMY E NAVY

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD. DETROIT · LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST., E.C.4

SAVE *Critical* TIME!



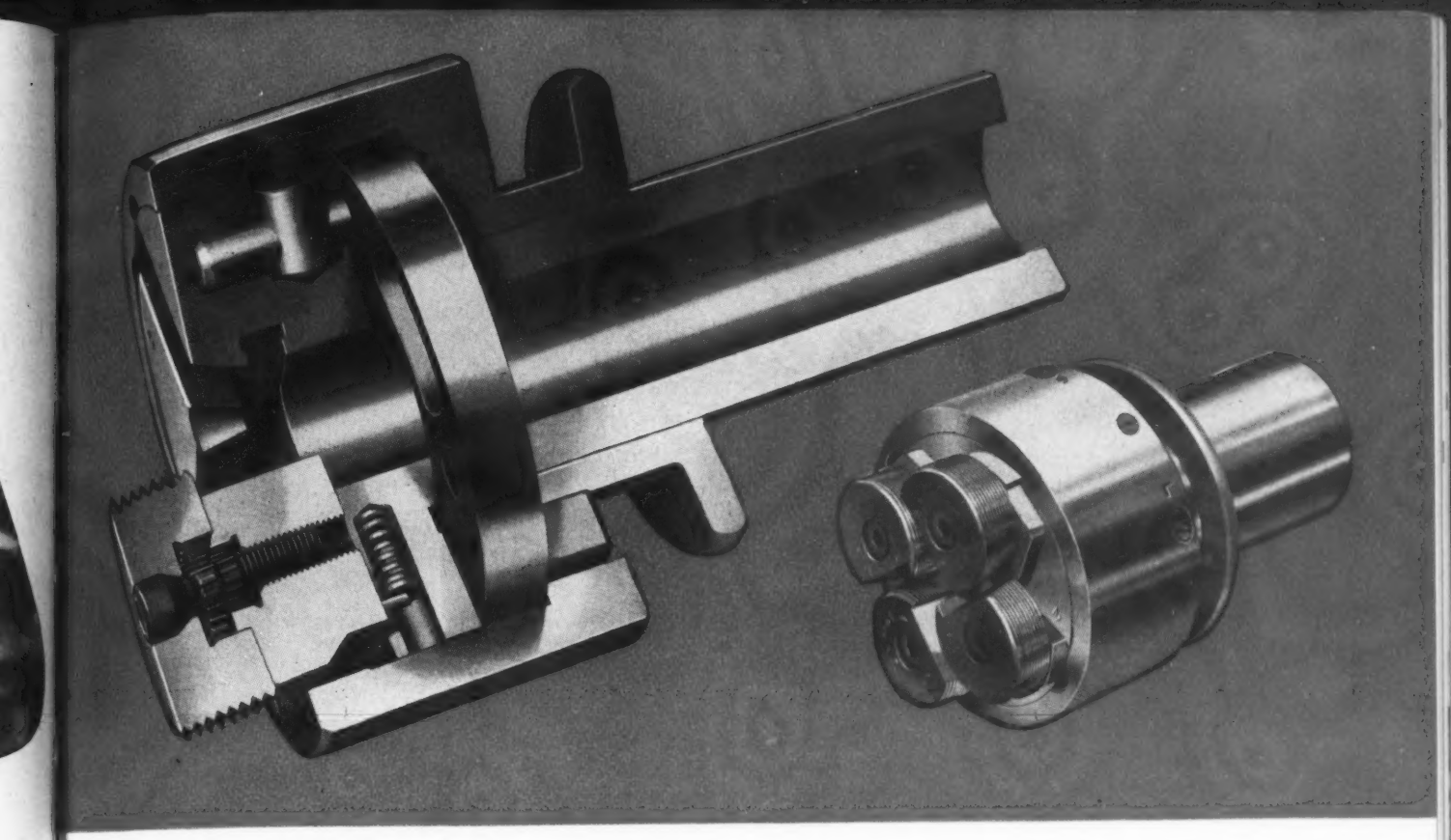
H-6
1/2 H.P. Countershaft drive, 4-speed —900—3400 R. P. M. Bench height pedestal mounting, 360 degree swivel.

TIME CANNOT BE SALVAGED

Once it's gone there's no reclaiming it. But you can cut your finishing time 'way down with Haskins Flexible Shaft Equipment. Forget old hand-finishing methods. Your men will work faster and better, with less fatigue, the Haskins way. Every hour will see increased production. Man-hours—plus machine-hours—will really mean something. For important new time-saver methods, send for your copy of Catalog 45. R. G. Haskins Company, 617 So. California Avenue, Chicago, Illinois.

HASKINS
Flexible Shaft
EQUIPMENT

More VERSATILE Machines for
More PROFITABLE Work



SIMPLICITY DOES IT!

Simple in design—that's the main reason for the strength, precision and unvarying performance of Namco Circular Chaser Dieheads.

Adjustment for all four cutting tools is quick and positive — through only two screws — and adjustment "stays put".

When Circular Chasers need replacement, a duplicate set can be inserted in head in two minutes. No trying for size, no delay, no spoiled work. Uniform production is maintained on long run lots of straight or taper threads on pressure-tight fittings.

Typical Namco Diehead job. Aircraft fitting —pressure-tight threads—Class 3 standard.

Circular thread chasers ground to gauge accuracy, may be reground through 270° circumference — they last ten to fifty times longer!

Chasers and blocks may be interchanged with circular hollow mills in the same double-duty head. Heads are available for both stationary and revolving spindle machines—capacities $\frac{5}{16}$" to $4\frac{7}{8}$".

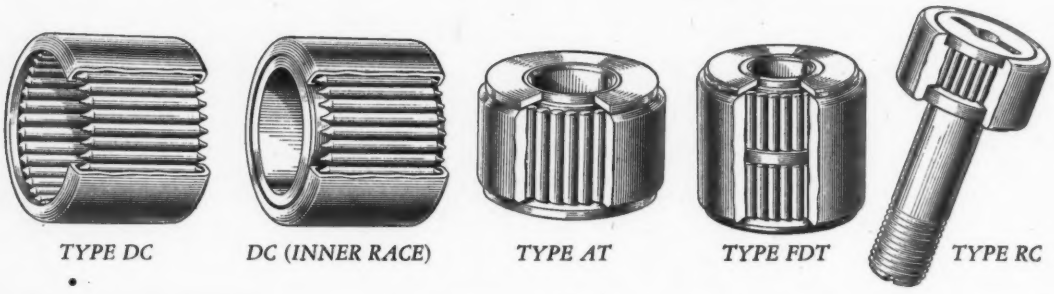
Here are the most efficient threading and hollow milling tools made—for a wide variety of work on all standard automatics. Catalog D-42 gives details.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING

These Needle Bearings ALL Have High Unit Capacity!



TYPE DC *DC (INNER RACE)* *TYPE AT* *TYPE FDT* *TYPE RC*

HIGH LOAD RATING IN PROPORTION TO SIZE AND WEIGHT IS IMPORTANT DESIGN FEATURE

As new applications have developed requiring a small size, lightweight, high capacity, anti-friction bearing, modifications have been made in the original Torrington Needle Bearing design until today a full line with a wide range of types and sizes is available.

All of these Needle Bearings offer the outstanding advantage of high unit capacity.

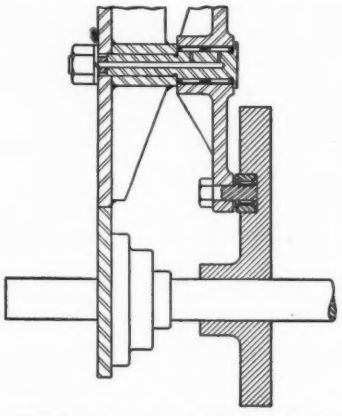
Their high radial load-carrying capacity is due to their basic design principle: A full complement of small diameter needle rollers held within a retaining raceway to form a single compact unit. Thus, in small space, more than double the "line contact" is provided than in other radial roller bearing types.

Weight distribution within the bearing's "load zone" is spread over a larger "area" and danger of stress concentration on races or rollers is consequently reduced.

"Heavy Duty" Types

Many of the newer types of Torrington Needle Bearings have been designed to utilize the full non-Brinell capacity available. For example, the FT Type is provided with a permanently attached inner race, hardened to a depth to carry the rated load of the bearing. The outer race is heavier and designed to serve without an auxiliary housing if desired.

Similarly, other RC Types for use primarily in the application of Needle Bearings as cam followers, have a heavy outer raceway and are designed for heavy rolling loads. Maximum static non-Brinell capacities extend from 1,410 to 133,600 pounds which provide the design engineer with a wide range in bearing selection. The Torrington Engineering Department should be consulted for capacity under rolling loads. Additional information will be found in our Catalog No. 111, available on request.



Application of the Type RC Needle Bearing in cam follower service and two DC Needle Bearings on rocker shaft are shown in this cross-section of a package sealing machine.

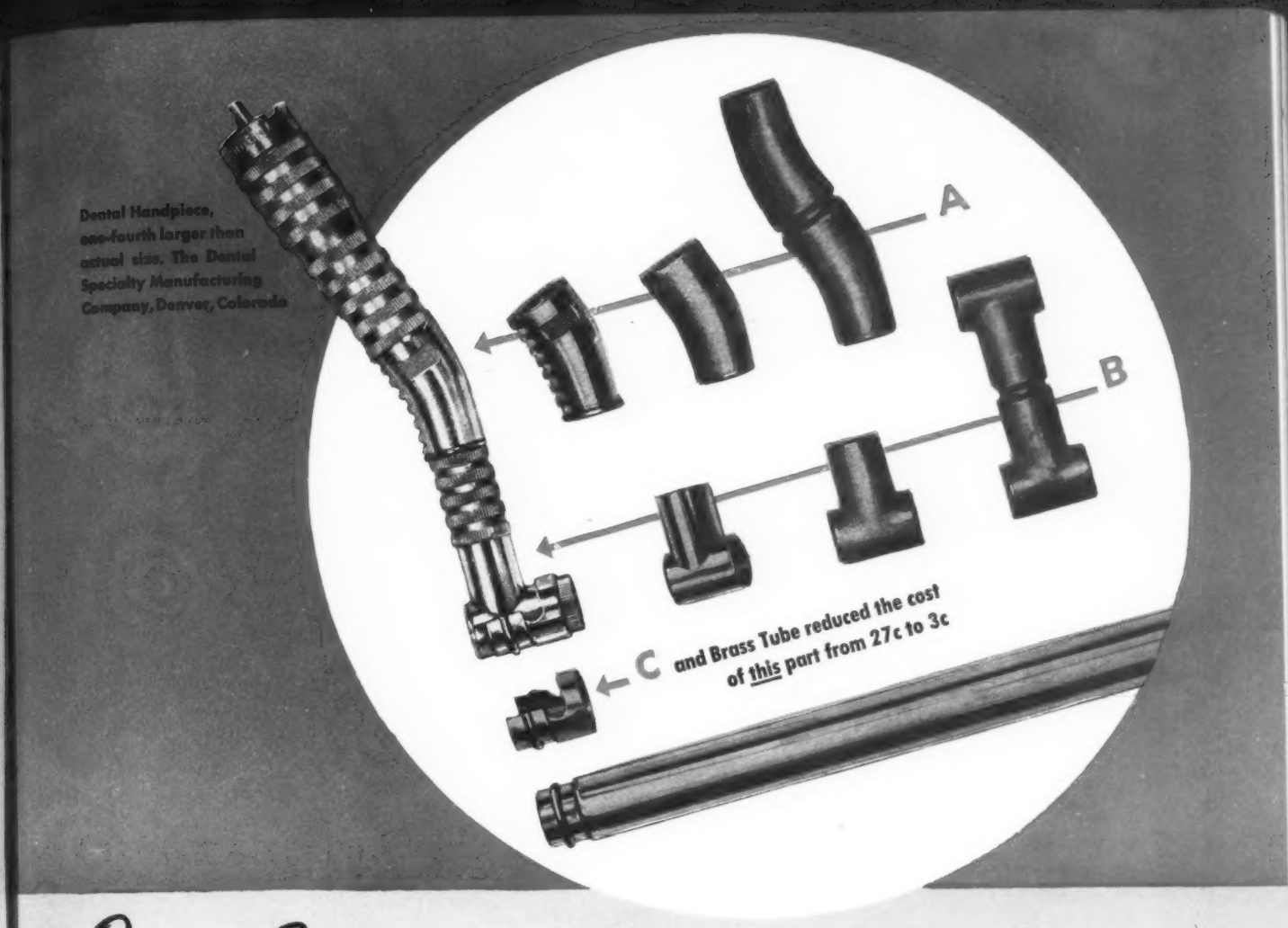
A Unique Combination of Advantages

All types of Torrington Needle Bearings offer the same outstanding advantages which gave the original unit such immediate and widespread acceptance. In addition to high capacity, they are small in size, light in weight. Their unit construction adapts them to mass production methods of assembly. They are easily and efficiently lubricated. And they are low in cost.

All these features are important in planning designs for today's needs and for "Tomorrow's" demands when reduced size, weight and cost will be important factors in contributing to increased production, distribution *and* operating efficiency. Our engineering staff will gladly work with you in selecting the Needle Bearing and in laying out applications.

THE TORRINGTON COMPANY
Established 1866 • Torrington, Conn. • South Bend 21, Ind.
"Makers of Needle Bearings and Needle Bearing Rollers"
New York Boston Philadelphia
Detroit Cleveland Seattle
San Francisco Chicago Los Angeles
Toronto London, England

TORRINGTON
NEEDLE BEARINGS


Dental Handpiece, one-fourth larger than actual size. The Dental Specialty Manufacturing Company, Denver, Colorado
A
B
C and Brass Tube reduced the cost of this part from 27c to 3c

Once Again Anaconda Hot Pressed Parts *improve the product...reduce the cost*

CUTTING manufacturing costs on a competitive product is always a worthy goal. But when the parts on which the savings were made prove to be stronger, result in fewer rejects, and serve better functionally, the accomplishment becomes doubly worthwhile—and is often the result of close cooperation between the manufacturer and the supplier of the metal. This was the case with THE DENTAL SPECIALTY MANUFACTURING Co., of Denver, Colorado.

Take part "B" for instance, on the dental handpiece illustrated: Originally the head slugs were made of round brass rod involving screw machine work, milling, annealing, die forming and then final machining. However, upsetting the metal in the forming die occasionally caused minute cracks which leaked grease when the part was machined to the necessary thin wall. Through the use of an Anaconda Hot Pressed Part, all operations but the final machining were eliminated. Result: A more accurately formed part of more dependable metal, no grease leaks—and a 50% reduction in costs.

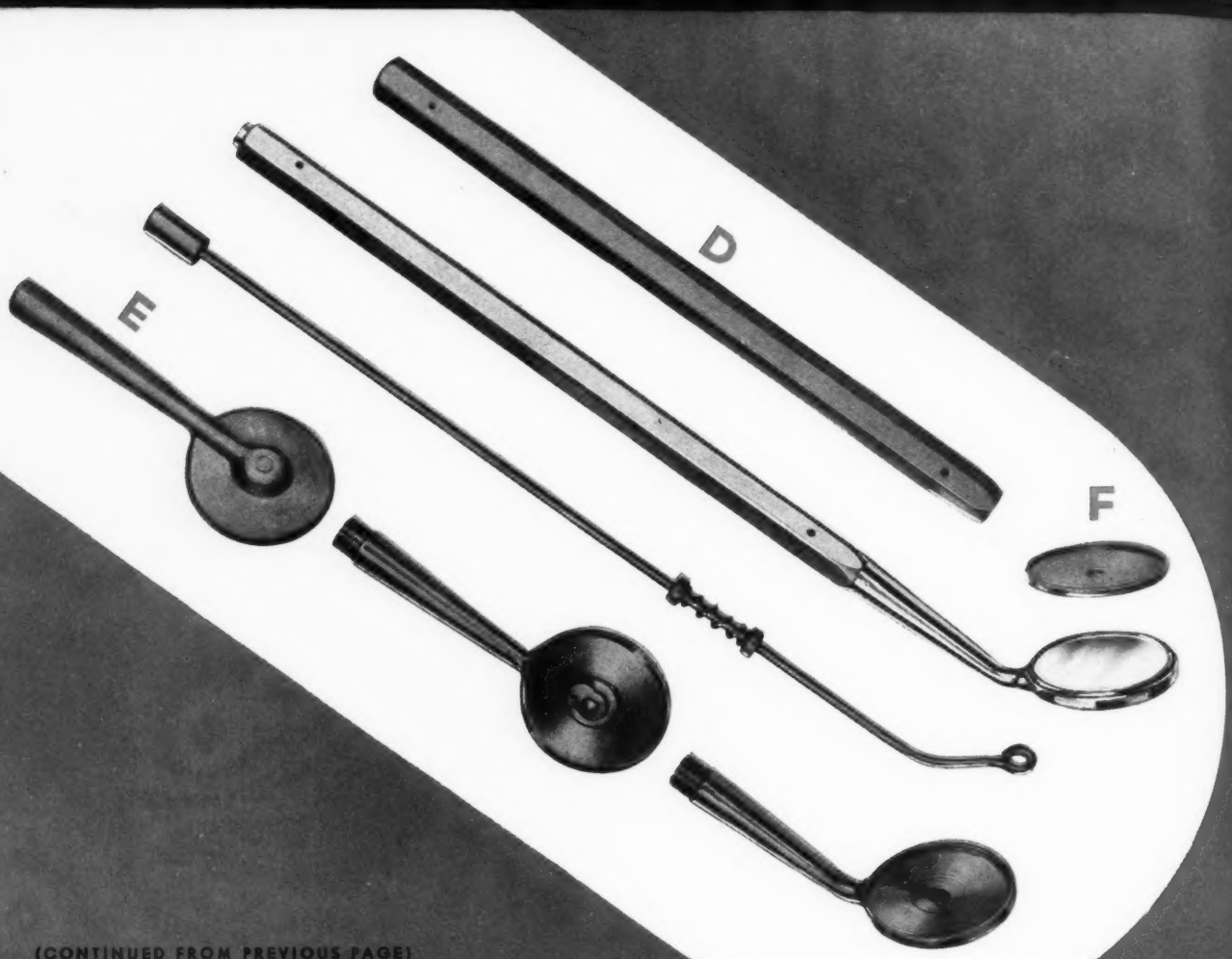
Practically the same conditions, and the same solution—another Anaconda Hot Pressed Part—applied to the elbow slug, illustrated at "A".

At "C" is shown the "Contra-Angle Head Shield." This shield slides down over a locking mechanism to prevent the whirling burr lock from contacting the patient's mouth. Formerly made of drill rod for its spring qualities, the shield was drilled out to a thin wall, hardened and ground to shape—an expensive and not too satisfactory procedure. A representative of The American Brass Company suggested that hard drawn brass tube, punched to shape, might serve equally well. It did—and costs were cut from 27c to 3c per piece.

(TURN TO NEXT PAGE, PLEASE)

ANACONDA
from mine to consumer

Anaconda Copper & Copper Alloys



(CONTINUED FROM PREVIOUS PAGE)

. . . and what better material than BRASS for a Dental Mirror assembly like this?

LET'S TAKE it apart, piece by piece, and see what brass and other copper base alloys have contributed to the design, appearance, and ease of manufacture.

The handle, "D" is a hexagon yellow brass tube. Drilled, chamfered on the ends and tapped with a fine-pitch thread, it is ready for plating.

"E" is another Anaconda Hot Pressed Part. One view shows the rear of the blank; another shows the part after the stem has been drilled, polished and threaded. The face is then recessed and the center counterbored for accurate movement of the wire loop which permits ready release of the mirror. After machining, the forging is bent to the desired angle.

The mirror holder "F" is a sheet brass stamping, fitted with a recessed brass pin that engages the wire loop. The push rod is a brass wire, hard enough to provide sufficient rigidity—yet soft enough to permit ready forming of the loop. Spacers and rod cap are free cutting brass, turned, drilled and cut to length. The spring is Anaconda Beryllium Copper—well known for its high resilience. This metal can be formed or machined in its softest form, then heat treated to a strength and hardness exceeding any other copper alloy.

All the parts illustrated are chromium plated—easily accomplished on brass because of its smooth finish and inherent capacity for quickly taking a fine polish from a simple buffing operation.

Needless to say we're proud of the volunteered statement of MR. R. W. BROWN, Vice President of THE DENTAL SPECIALTY MANUFACTURING CO.: ". . . our successful reduction in costs was due to the efforts and help extended to us by your local Denver Office which, for the past several years, has cooperated with us on many new developments".

Perhaps we can be of similar service to you or your engineering department.

ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut · Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production

★ Adaptability

Fixture Saving

Operation Saving

Material Saving

Fine Finish

★ Flatness

Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

Grinding Steel Forged Rocker Arms on No. 11 Blanchard Surface Grinder

These steel forged Rocker Arms are ground on a No. 11 Blanchard Surface Grinder, with speed and economy.

Twenty pieces are loaded on a special Blanchard designed fixture. .005" of stock is removed from one side.

1800-2000 pieces are produced per eight hour shift.

The BLANCHARD

BLANCHARD

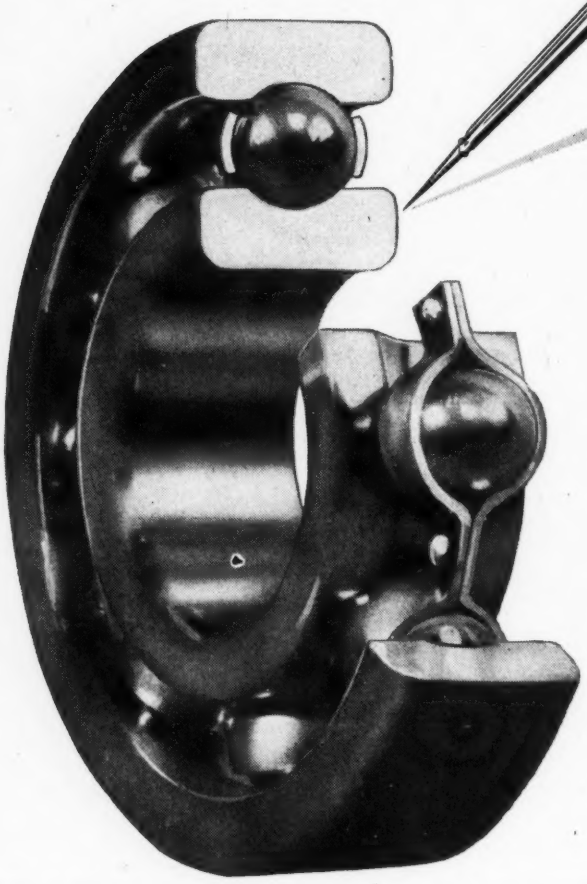
MACHINE COMPANY

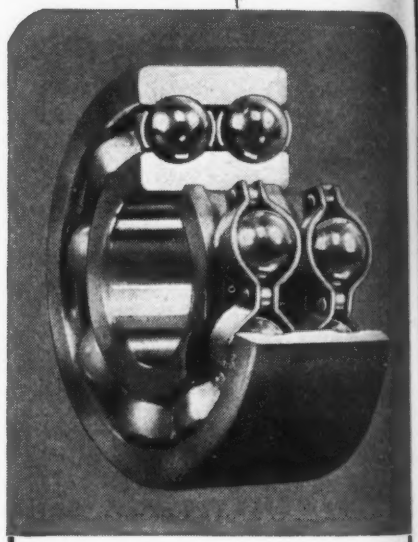
64 STATE STREET, CAMBRIDGE 39, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

"Standard Equipment"

FOR POST-WAR DESIGN





POST-WAR design will change many familiar machines . . . create new ones. But post-war design will not change the tested principle that no machine can out-perform its bearings.

BCA Ball Bearings . . . proved in the past . . . proved in the present . . . will remain "standard equipment" for machine makers and machine users who demand bearings that are soundly engineered . . . carefully manufactured . . . rugged . . . and with ample load capacity to meet service requirements.

The performance of BCA Ball Bearings is one stable factor upon which you can base future design or purchase, no matter how far ahead you may be planning. Tomorrow, as ever, BCA Ball Bearings will safeguard the machine maker's reputation . . . the machine user's production. Plan now to be sure they're part of your post-war equipment.

BEARINGS COMPANY OF AMERICA, LANCASTER, PENNA.

BCA

RADIAL • ANGULAR CONTACT • THRUST

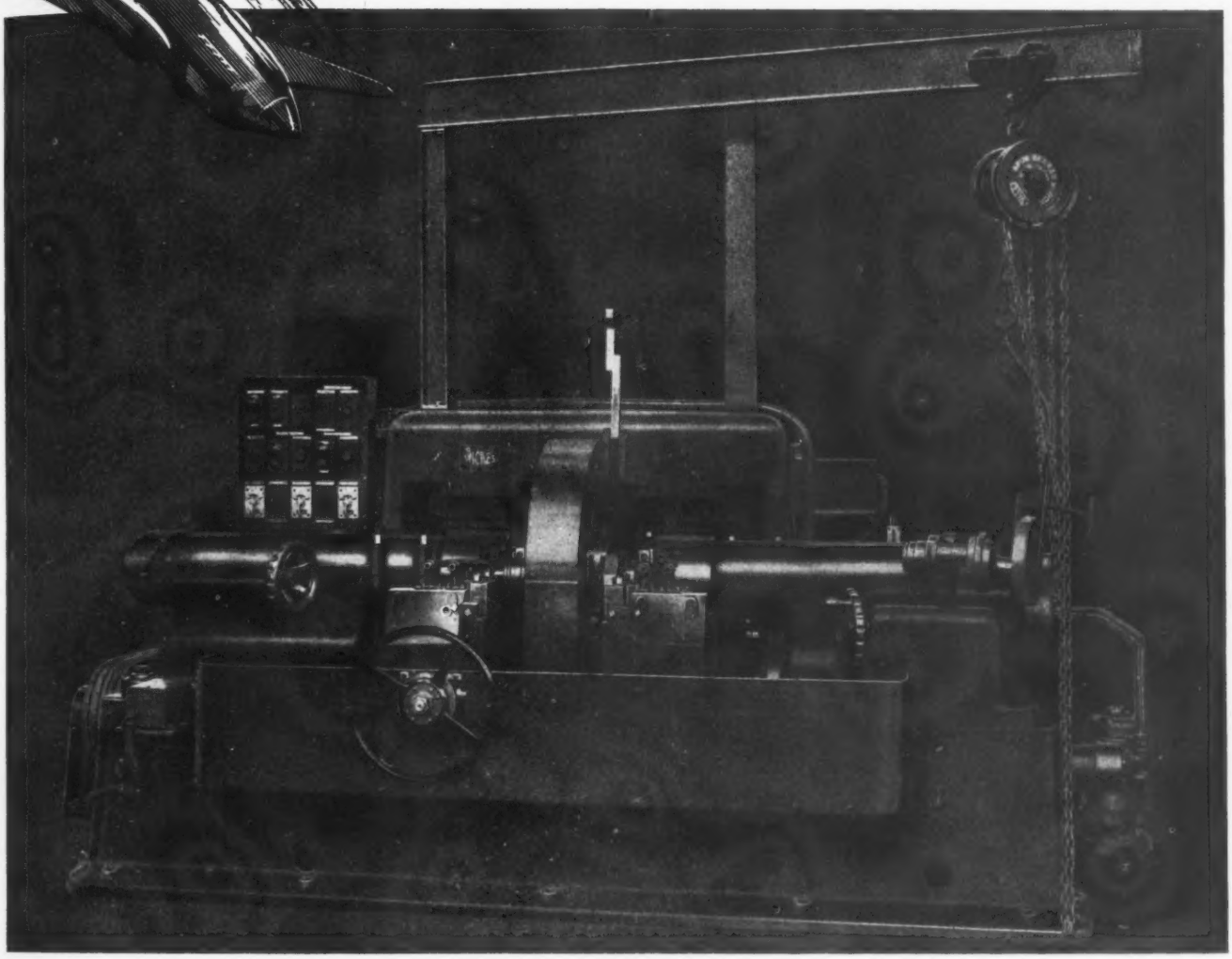
BALL BEARINGS

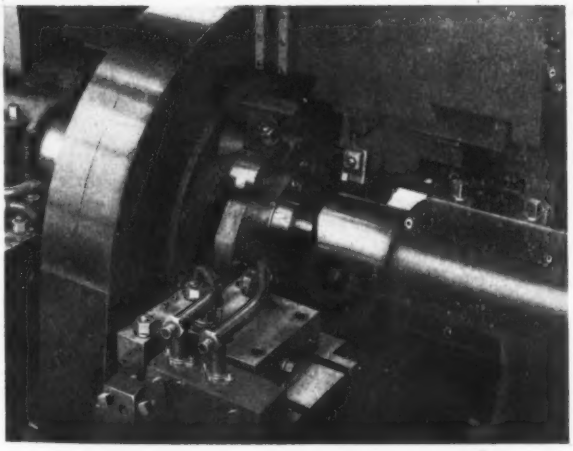
Treat Bearings Right!
They're in the Right!

1. Use only neutral mineral lubricants.
2. When lubricating with grease, it is not advisable to have the housing more than one-half to two-thirds full. Too much grease may cause generation of heat faster than it can be dissipated by the surrounding housing.

Standardize on Standard Sizes.

WICKES AUTOMATIC
CENTER DRIVE CRANKSHAFT LATHE





This efficient new Wickes Model CH-8 Automatic Center Drive type lathe is ideal for machining the main line bearings, stub-end, flange and oil slinger complete on crankshafts for airplane, truck and tractor both gasoline and Diesel engines. By setting up duplicate lathes, the second tooled for finish turning the same parts, you can save considerable time and labor by eliminating rough grinding operations.

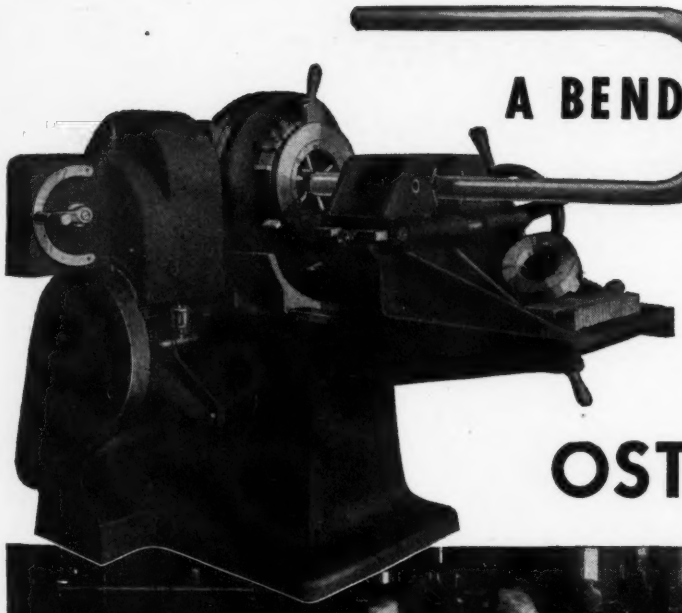
View above shows lathe with loading device. View at left shows tooling for machining rear end of two throw crankshaft.

Entire operation is automatic and controlled by an electrical push-button panel. Write today for complete facts about this and other Wickes automatic lathes.

Wickes Lathes CUT COSTS • SPEED PRODUCTION

WICKES BROTHERS • SAGINAW, MICHIGAN • EST. 1854

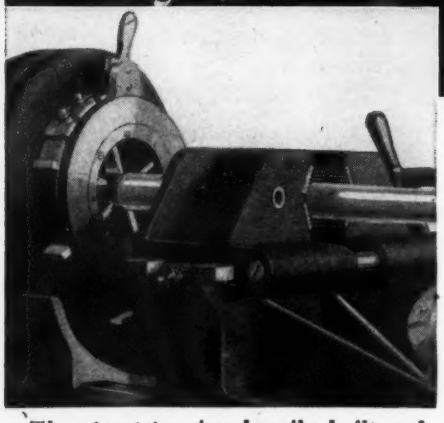
Crankshaft Turning Equipment • Double-End Boring, Heavy Duty Engine, and Special Production Lathes • Simplex Blue Printers



A BEND CAN'T BALK THE JOB WHEN IT'S THREADED ON

NO. 300

OSTER MACHINES



The open-type vise, heavily built and accurately designed to grip pipe securely without squeezing it out of round. Mounted in front of die-head. Bent pipe can be handled as easily as straight pipe.

Open type vise and revolving die-head on the Oster "No. 300 Series" machines make it easy to perform a wide variety of threading operations with no complicated, expensive changes of equipment.

Long or short, bent or straight pipe, nipples, rods, studs and bolts are threaded with ease and speed on these strictly modern, all-purpose threading machines.

Three Sizes in the No. 300 Line

No. 302. Regular range, ¼" to 2" pipe; Extra range, ⅛" pipe; Bolt range, ½" to 1¼".

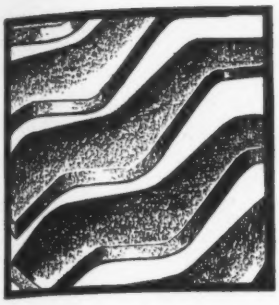
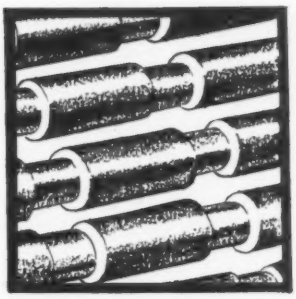
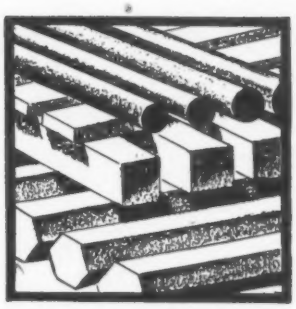
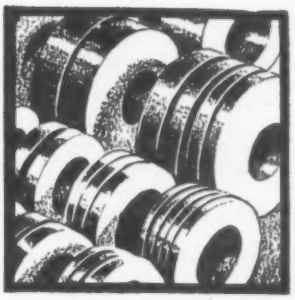
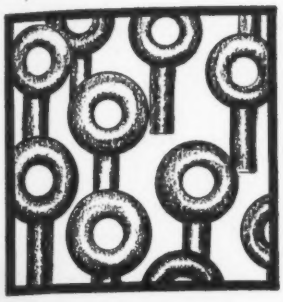
No. 304. Regular range, 1" to 4" pipe; Extra range, ½" and ¾" pipe; Bolt range, ¾" to 1⅜".

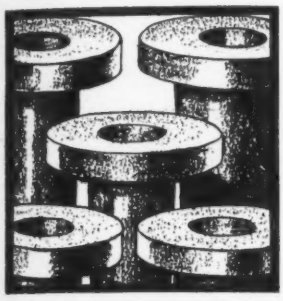
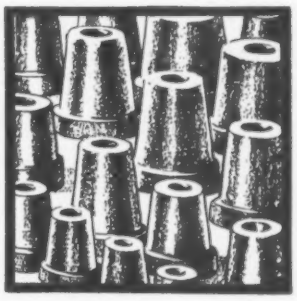
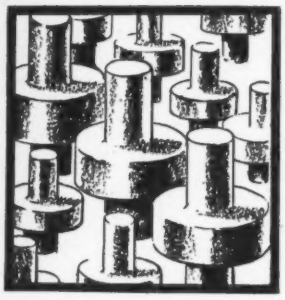
No. 326. Regular range, 1¼" to 6" pipe. Extra range, 1" pipe; Bolt range, 1" to 2".

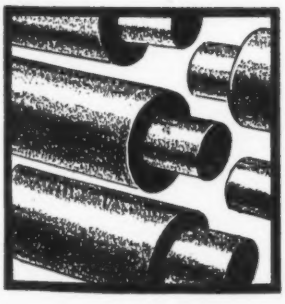
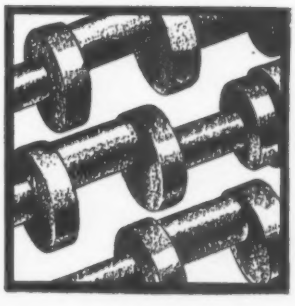
Complete data in illustrated CATALOG 12-A. *Write for a copy today.*

OSTER ***for faster, better threading***

THE OSTER MANUFACTURING COMPANY, 2073 EAST 61st ST., CLEVELAND 3, OHIO, U. S. A.

Do You Need Hammer Forgings or Upset Forgings?

Capacity is now available at Kropp Forge for hammer (flat die) forgings—large or small, singly or in any quantity; also for upset forgings up to 5" in size. The completion of part of our war assignment has released these facilities for those with adequate priority ratings.

If you need forged bars, blanks, rings, axles or other hammer-forged parts—or upset forgings—Kropp is prepared to start production on your order as soon as the steel is available.

Call the nearest Kropp engineering representative, or send your blue prints with complete details direct for immediate quotation.

(Our drop forging capacity is still completely scheduled for some months in advance on essential war orders.)

KROPP FORGE COMPANY

5301 W. Roosevelt Road

Chicago, Ill.

Makers of Drop, Upset and Hammer Forgings
"World's Largest Job Forging Shop"

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ARMY E NAVY

One Reason Why

CONOMATICS

are

Easy to Operate-

Outstanding in

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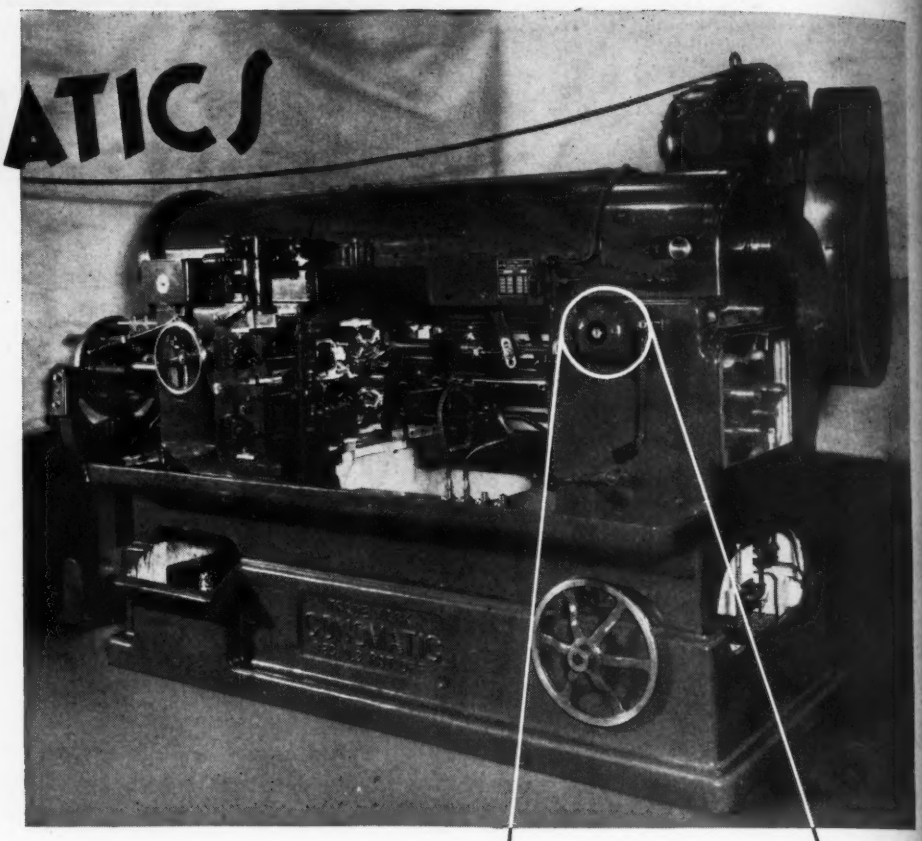
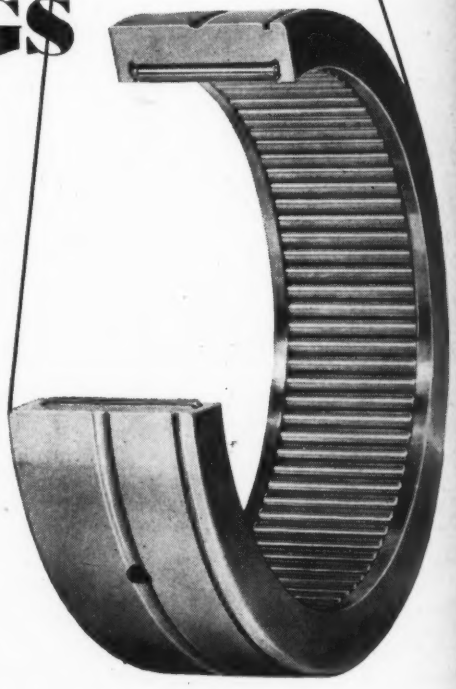


They are equipped with

RBC

NEEDLE BEARINGS

Automatic machines, more than any other type, must be built and equipped to require a minimum of maintenance service and replacement of parts. In RBC CYCLOPS Needle Type Roller Bearings, this Conomatic six spindle bar machine takes full advantage of their anti-friction characteristics, high load-carrying capacity, easy lubrication and the rugged durability of high carbon alloy bearing steel. The cross feed shaft and pump chain idler of this Conomatic machine employs RBC CYCLOPS Bearings as shown without inner races. They are made in sizes to fit shafts from ½" to 9¼" in diameter.



A number of Conomatic four spindle machines are used in the manufacture of RBC Bearings

ROLLER BEARING CO. of AMERICA

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Standard Motor Control

FOR POSTWAR RECONVERSION

Westinghouse All-Purpose A-C Controls

Postwar reconversion will bring important control problems—you'll need all-purpose controls—and you'll need them quick.

Westinghouse is ready NOW to help you solve these problems—with a complete family of A-C Controls, a few of which are pictured here. They offer the maximum in flexibility of application and ease of installation.

Start now to anticipate your postwar control needs. For your assistance, Westinghouse has compiled a complete new volume of Control Buying Data (Catalog 7000). Get your copy today from the nearest Westinghouse district office (distribution will be made from district offices only—no mailings from Westinghouse headquarters). Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penna.

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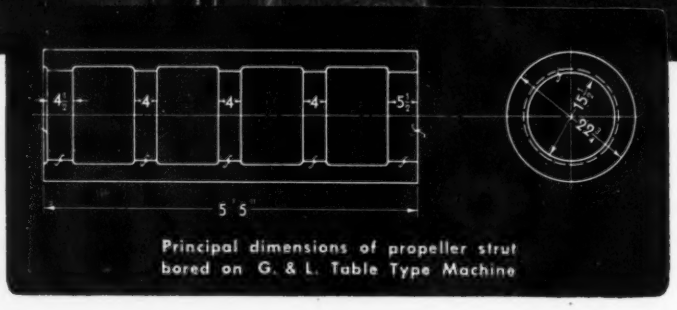
Motor Control

How to Bore Deep Holes on Your Horizontal Boring Mill



Principal dimensions of propeller strut bored on G. & L. Table Type Machine

(Above) Operation view showing simplified method of setting up and clamping 8000-lb. steel weldment prior to machining.

G.&L. Table Type Machine Does the Job with Simple Set-up and Tooling...

If you have occasional deep hole boring operations, with or without intermittent cuts, you will be interested in how this manufacturer simplified the job.

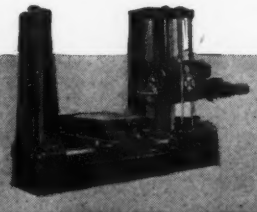
The large weldment weighs approximately 8000 lbs. and requires boring and face milling of both ends. Only rough boring operations are required. Note the simplicity of set-up. Details of the operation are shown on the opposite page.

This is another interesting example of how G. & L. Horizontal Boring, Drilling and Milling Machines are used to perform an endless variety of machining operations. If you have any problems in connection with your horizontal boring, drilling and milling machines, G. & L. engineers will be glad to work with you in finding the most practical solutions. You can use their experience without obligation.

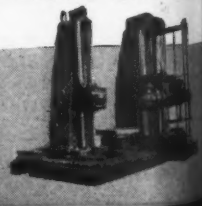
G&L

GIDDINGS & LEWIS

140 DOTY STREET



Right: G. & L. Table Type Machine.



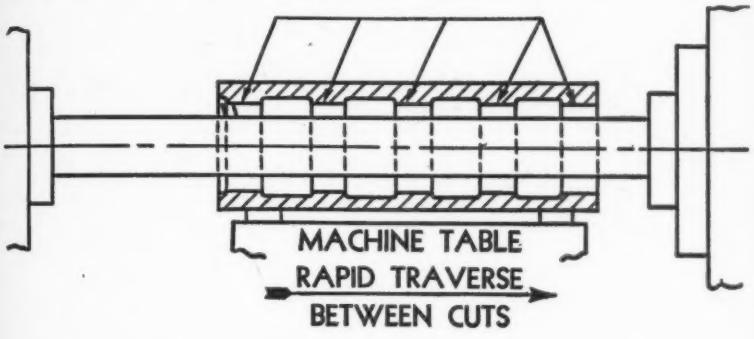
Right: G. & L. Floor Type Machine.

OPERATIONS

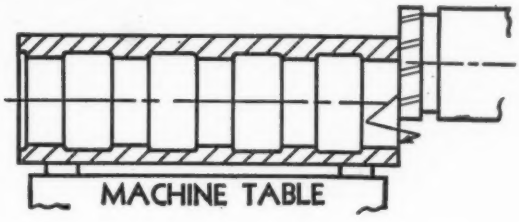
The cylinder is rough bored and face milled on both ends in two set-ups. Face milling operations are performed because the surface to be machined is $3\frac{5}{8}''$ wide. This surface, if smaller, could be machined by back-facing with the boring bar.

First Set-up

Weldment is loaded on machine as shown in the illustration on the opposite page. The intermittent bores are then machined by feeding through each cut and applying the rapid traverse of the table in between cuts. Two rough boring cuts are performed. Subsequent finish boring operations are performed after installation with portable boring equipment. The second operation in the first set-up consists

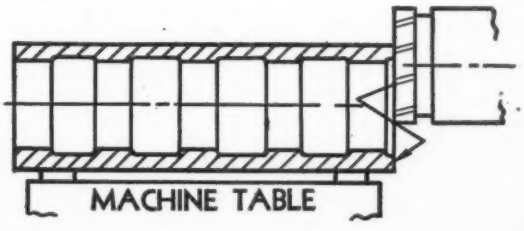


of face milling the end. Milling is performed by utilizing the feed of both the machine headstock and table.



Second Set-up

The weldment is now turned 180° on the table and the opposite end face milled similar to the second operation in the first set-up.



Do More Jobs . . . Save More Time with G.&L. Attachments and Accessories

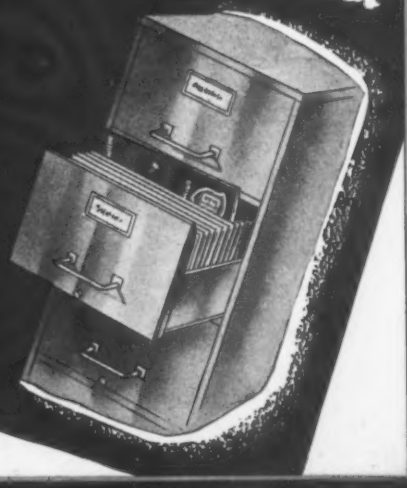
These are only three of many G. & L. accessories and attachments designed and built to increase machine flexibility and save time. If your work includes an endless variety of parts, you can use some of these attachments profitably. For instance, the Continuous Feed Facing, Boring and Turning Head makes it possible to face and bore simultaneously. Many other operations and combinations of operations, not ordinarily performed with the Horizontal Boring, Drilling and Milling Machine, are possible with this attachment. Write for the G. & L. General Catalog which describes all additional time-saving devices.

(Left) Precision Rotary Table with Power Feeds and Rapid Traverse.

(Right) Right Angle Attachment.

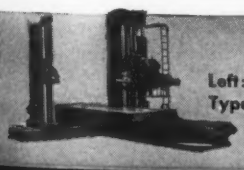
(Left) G.&L. Continuous Feed Facing, Boring and Turning Head.

Additional Data

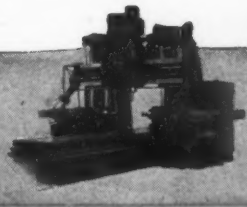


MACHINE TOOL CO.

FOND DU LAC, WIS.



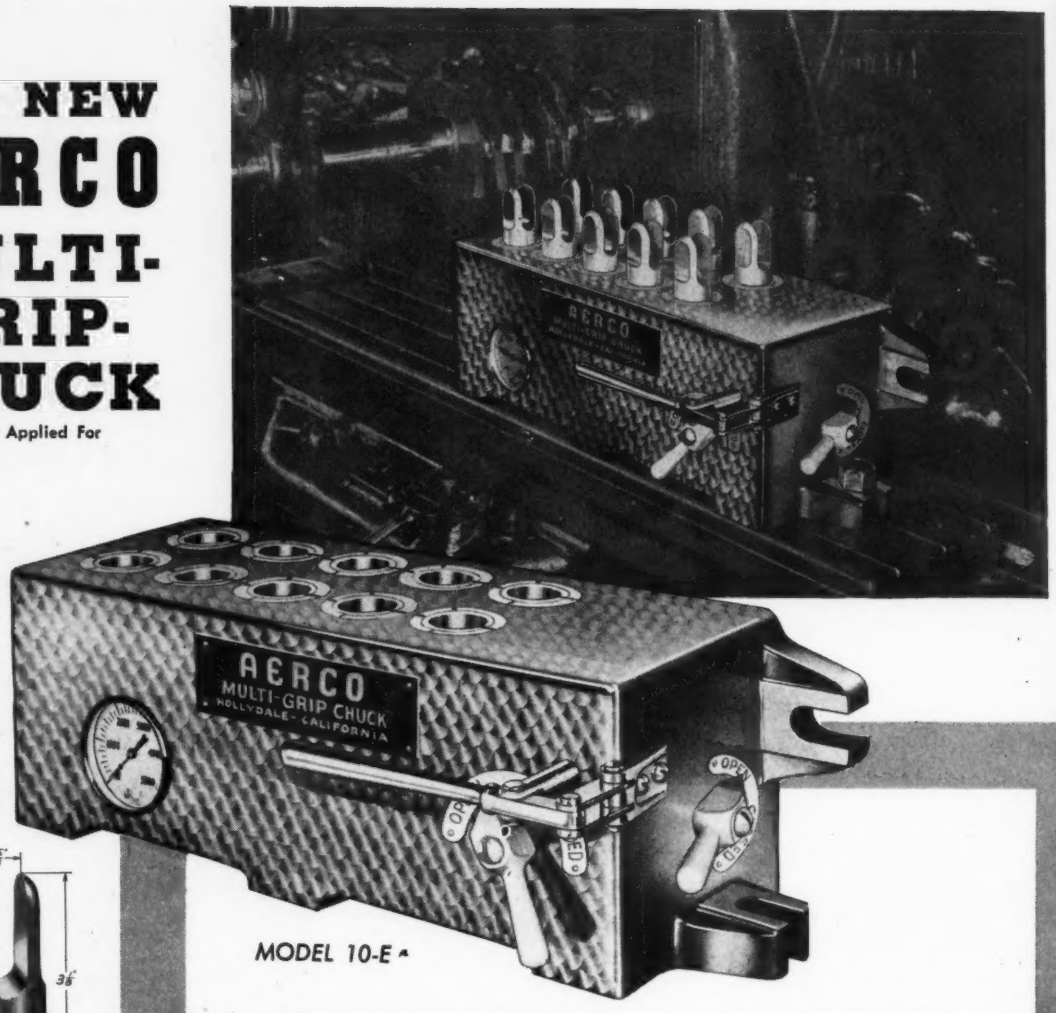
Left: G. & L. Planer Type Machine.



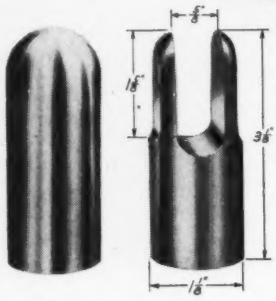
Left: G. & L. Multiple Head Type Machine.

THE NEW AERCO MULTI-GRIP-CHUCK

Patent Applied For



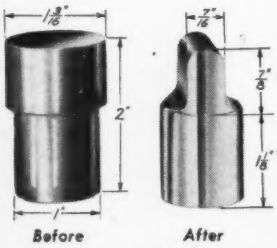
MODEL 10-E



Before After

Aluminum Parts

These aluminum parts were milled upon the Aerco Multi-Grip chuck at the rate of 355 per hour (floor to floor) as compared with single milling operations of only 71 per hour.



Before After

Chrome Steel Parts

These parts, high heat treated of Chrome-moly, were produced at the rate of 62 per hour (floor to floor) on the Aerco Multi-Grip Chuck. Individual milling time was 15 per hour.

MULTIPLIES MILLING OUTPUT

Without Added Men or Machines

Not one, but ten pieces are milled with a single loading—with production increases from 100 to 500%.

Two rows of collets hold ten parts so that both rows are milled simultaneously. Collets range from ½" to 1¼" inclusive.

In spite of any slight variations in shank diameters, parts cannot be milled off-center, because self-centering aligning collets insure exact concentric position. Safety stop prevents damage to collets should all stations not be filled.

A few strokes of the hydraulic hand pump lever builds pressure to 3000 p.s.i. Work is held rigidly in collets and cannot turn or be pulled out during milling operation, however clamping pressure is instantly released when desired. Self-opening collets are quickly re-loaded.

For complete information, write or wire

AERCO CORP.

HOLLYDALE, CALIFORNIA

Manufacturers of precision equipment for Aviation and other industries.

ARMY E NAVY

SMALL things make perfection; perfection itself is no small thing. Thus, perfect accuracy of thread angle, lead, and pitch diameter is achieved for Shield Brand Taps by a whole series of infinitely careful tests, checks, inspections, and scientific measurements which enable us to determine and correct the slightest variation from absolute accuracy—and achieve perfection.

Thus, Shield Brand Taps are specified, used, and preferred in those mass production industries where absolute accuracy is essential to lowest cost production. This same quality will cut your costs and speed production. Leading Industrial Supply Houses from coast to coast stock and supply these perfect Shield Brand Taps.

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SOUTH BEND LATHES

BUY WAR BONDS

ARMY E NAVY

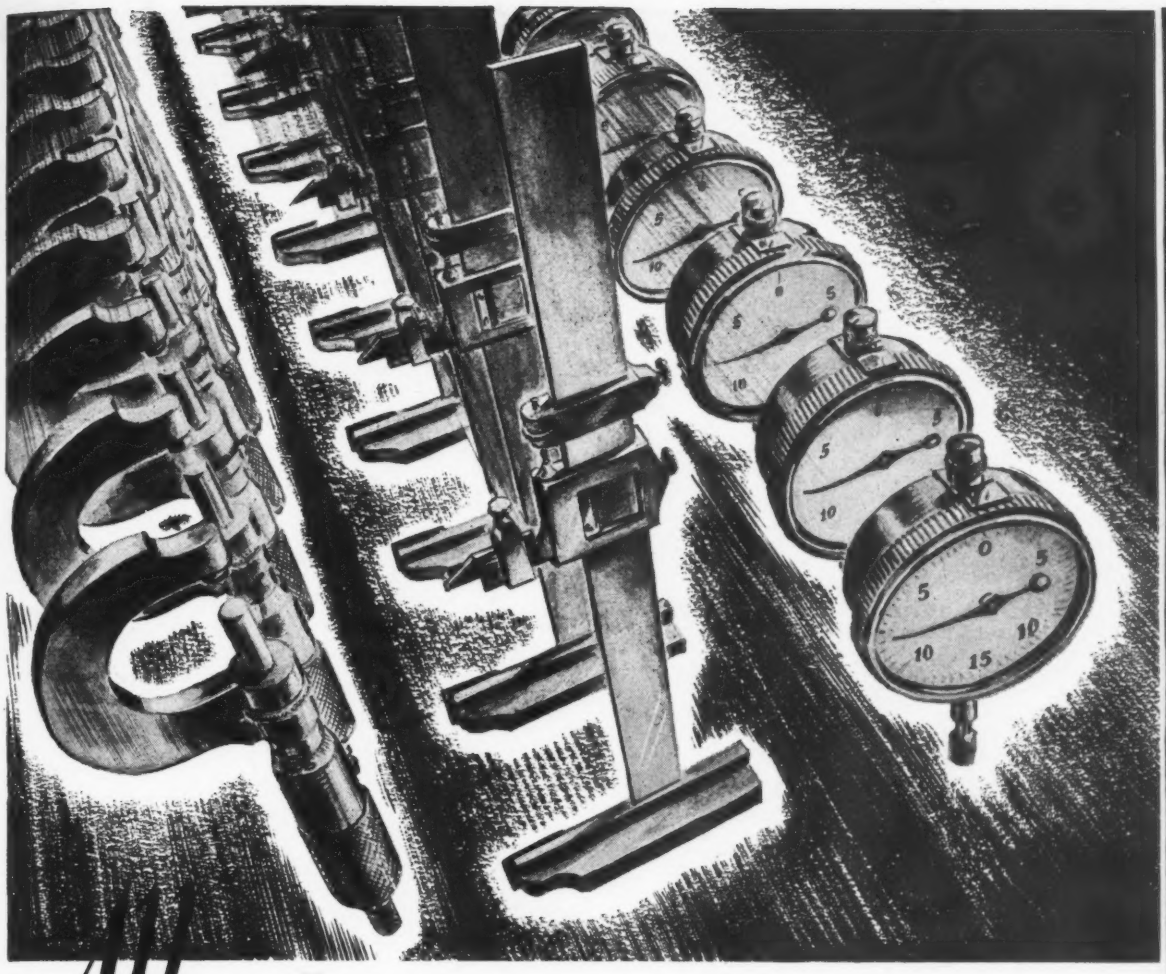
War production demands uniform accuracy. Loss of time or the waste of scarce strategic materials because of variations in machining cannot be tolerated. There is no place in our war production plan for equipment that cannot be relied upon to maintain required tolerances.

Sound design and careful workmanship give South Bend Lathes the dependable precision that assures uniform accuracy. Built by skilled craftsmen who take pride in their work, they are capable of maintaining split-thousandth tolerances on all work within their capacity. Their unvarying performance speeds production on the most exacting machine operations and assures perfect interchangeability of parts and units.

There is a South Bend Lathe for most war production requirements. The Engine Lathes are made in 9″, 10″, 13″, 14½″, and 16″ swings, with bed lengths from 3′ to 12′. The Toolroom Lathes are made in 10″, 13″, 14½″, and 16″ swings, with bed lengths from 3′ to 8′. The Turret Lathes are made in 9″ and 10″ swings, with 3½′ bed lengths. These lathes are described in Catalog 100C which will be sent upon request.

SOUTH BEND LATHE WORKS

SOUTH BEND 22, INDIANA • LATHE BUILDERS FOR 37 YEARS



STARRETT TOOLS

All MADE TO STARRETT STANDARDS OF QUALITY AND ACCURACY, HOWEVER URGENT THE DEMAND

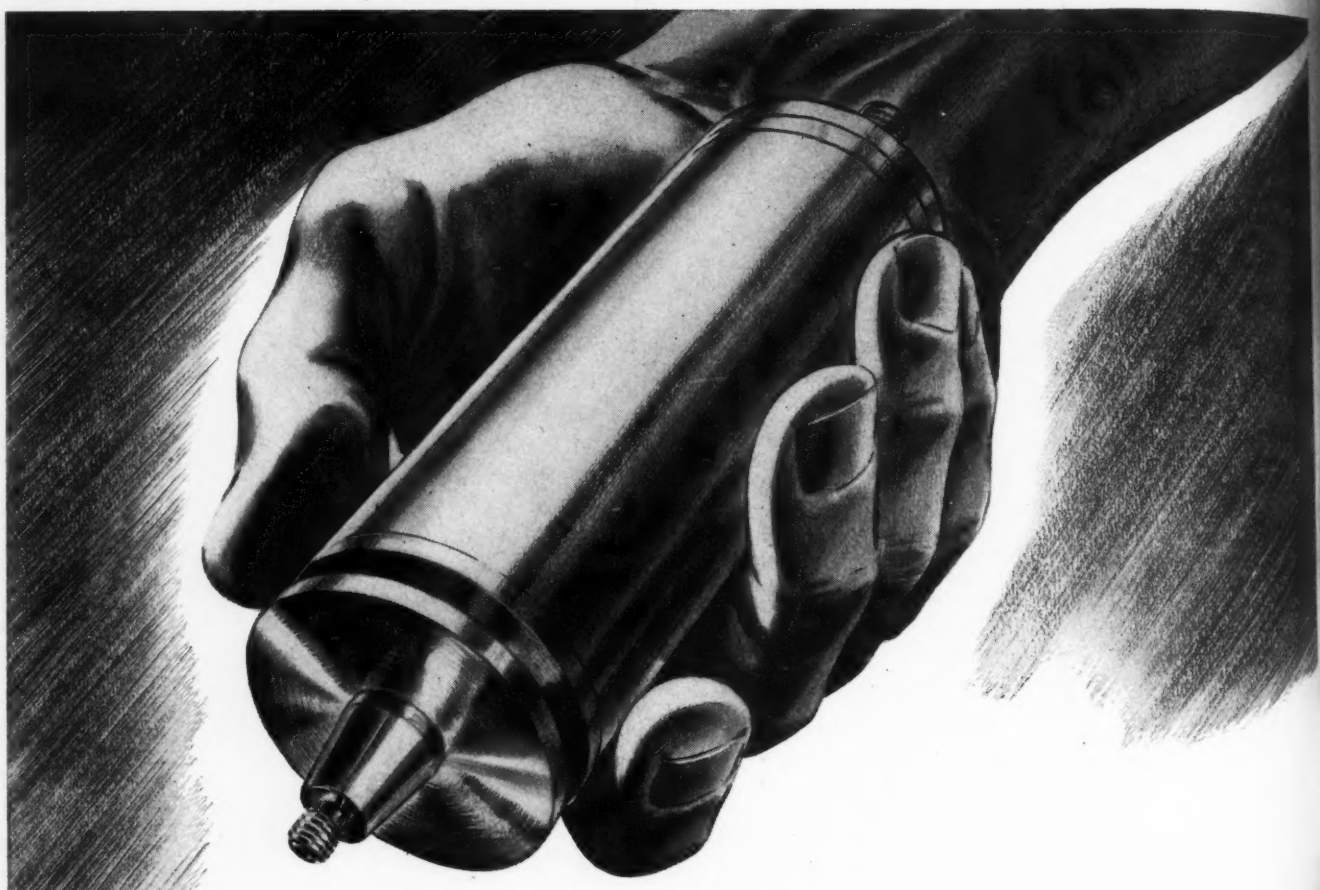
Long after the war is over the makers of Starrett Tools will remember with pride that Starrett precision and Starrett workmanship were steadfastly maintained—this despite the critical pressure for delivery of tools without which mass production of superior weapons and armament would never have been achieved.

It took years to develop and perfect Starrett standards and the extreme demands of wartime production have served to emphasize their value. The quality and accuracy of Starrett Tools will stand you in good stead whatever demands the future may make upon you.

THE L. S. STARRETT CO · ATHOL · MASSACHUSETTS · U. S. A.

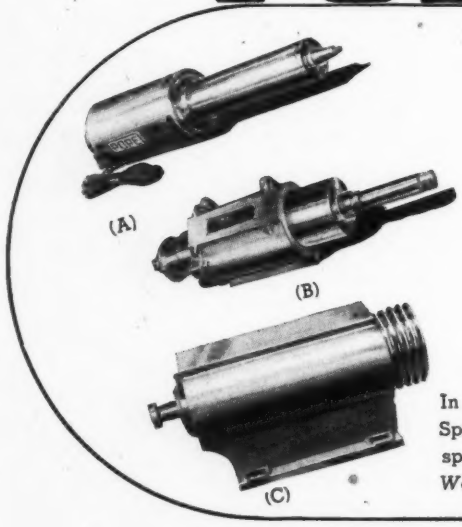
World's Greatest Toolmakers

Now, with Service Star



HERE'S ALL THERE IS TO A

POPE *Precision Grinder Spindle*



No oil cups, wicks or fittings — the lubricant is *sealed* in. No chance to inhale dust or grit of any sort. Just a complete, self-contained package ready to work smoothly, coolly and indefinitely at its job of producing superb surface finishes.

There is a size and type of POPE Precision Spindle for every service. Once you try them — see how they perform — you will standardize on POPE Sealed Lubrication Spindles.

Let us mail you new descriptive Bulletin "M" containing complete information.

In the hand is a Tool and Cutter Grinder Spindle. At left is (A) a Surface Grinder Spindle, (B) a special Spindle for winding Glass thread at high speed, and (C) a special Wheel Head for grinding tank and aircraft bearings. You name the job. *We'll* build the one best Spindle for it.

POPE MACHINERY CORPORATION

ESTABLISHED IN 1920

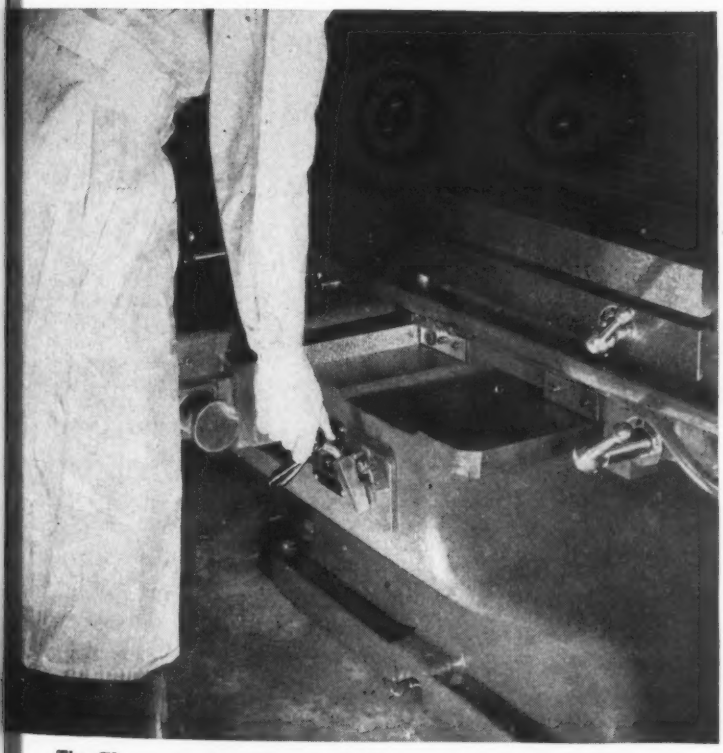
HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION GRINDER SPINDLES

Cleereman

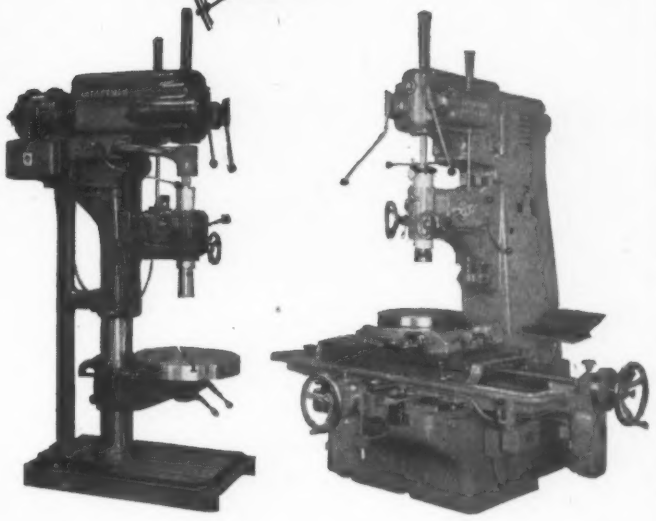
Jig Borers and Drilling Machines

All control movements on Cleereman machines are made from the operator's position.



The Cleereman Jig Borer spindle control is conveniently mounted on the front of the base.

ARMY E NAVY



"Cleereman Controls Increase Output"

Correct speeds, increased output, and minimum operator effort are the results of convenient grouping and ease of operation of controls on *Cleereman* machines. Single lever selectors for speeds and feeds, binder levers, hand wheels, clutch levers, and the start-stop-reverse lever—are all easily reached from the operator's normal working position.

Added to this control feature, Cleereman machines also offer extreme range of adaptability, unexcelled accuracy, high speed production, and long working life.

Write for the new Cleereman Jig Borer and Drilling Machine catalogs!

BRYANT MACHINERY & ENGINEERING COMPANY

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No "softies", these "Unbrako" Self-Locking Hollow Set Screws! Made tough at the start, they're hardened to "stand the gaff" and possess almost unbelievable strength, as proved by actual physical tests. What's more, they defy the menace of vibration and will not work loose of their own accord. When tightened as usual, the knurls *dig in and lock automatically.* Yet they can be readily removed with a wrench and used over and over again any number of times. Available in all sizes from No. 4 to 1½" diameter. Remember the name—be sure to specify "Unbrako" on your next order.

Knurling of Socket Screws originated with "Unbrako" years ago.

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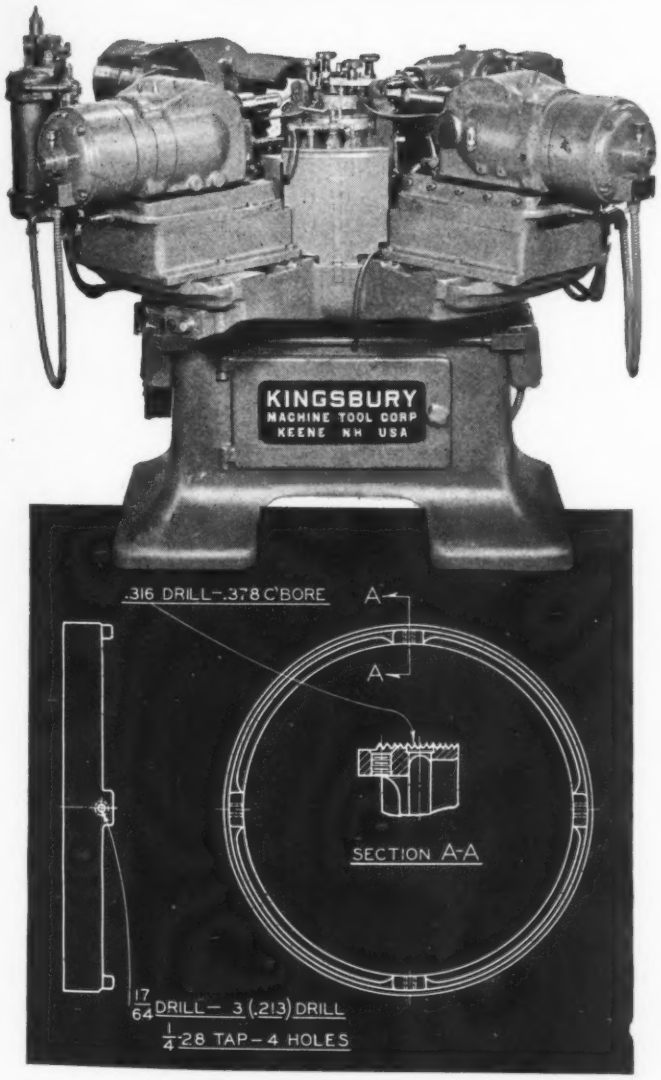
FLEXIMATIC

by KINGSBURY

Produces Accurate Aircraft Parts in One Chucking



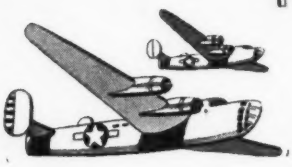
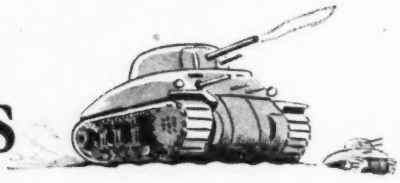
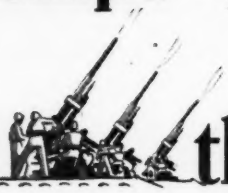
IN precision jobs on aircraft parts, FLEXIMATICS are demonstrating their speed, ease of operation and accuracy, enabling unskilled operators to produce complicated parts to high degrees of precision. The machine illustrated is a case in point. In one chucking it drills, counterbores, countersinks and taps five holes in dome retaining nuts for airplane propellers. The work is clamped in the fixture, the machine is tripped and thereupon functions automatically, indexing the work and performing the various operations until they are all completed.

The FLEXIMATIC method of mounting any number of units on one of several types of standard bases speeds up tremendously the designing of special purpose machines. And this method has the added advantage of FLEXIBILITY that permits quick changeovers to meet varying design and machining requirements.

THIS IS ANOTHER

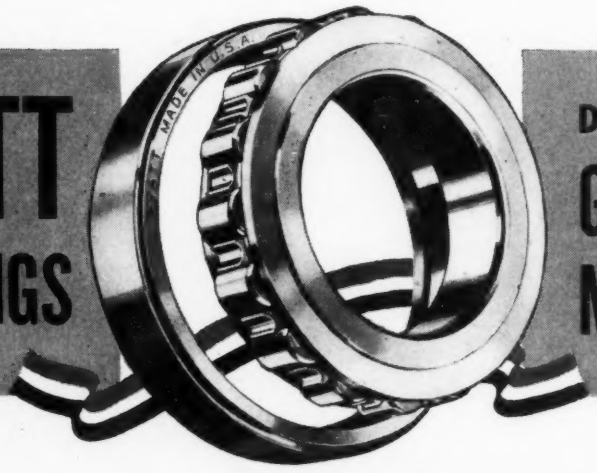
Fleximatic

AIRCRAFT JOB!

All of Hyatt's Production now goes into planes  our men fly ...into tanks  they drive... into ships they sail...into guns  they man...into equipment they need to win.

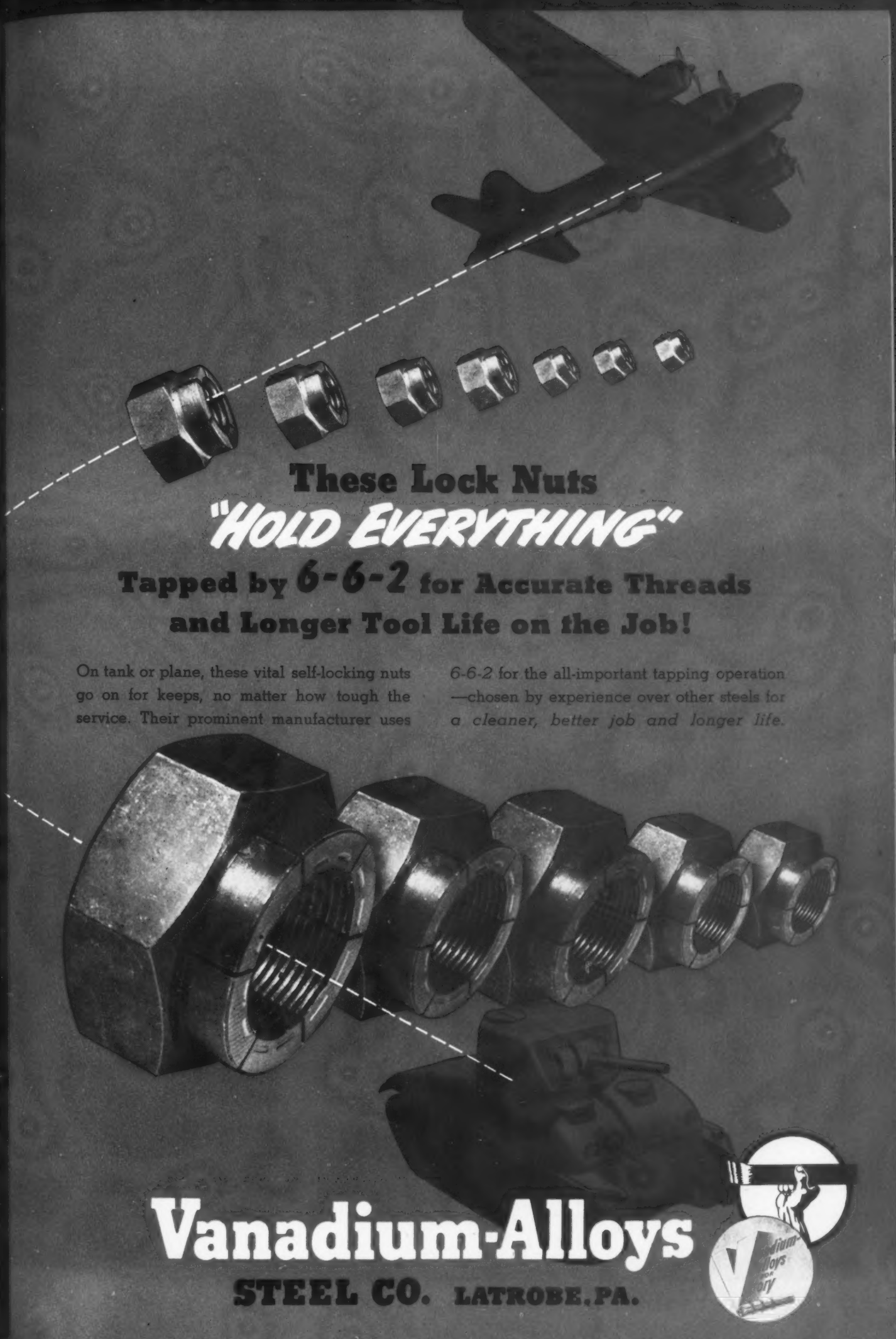
HYATT ROLLER BEARINGS SERVE SILENTLY, ACCURATELY, EFFORTLESSLY WHEREVER GEARS, SHAFTS, AND WHEELS TURN

HYATT BEARINGS



DIVISION OF GENERAL MOTORS

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY


These Lock Nuts
"HOLD EVERYTHING"
Tapped by 6-6-2 for Accurate Threads
and Longer Tool Life on the Job!
On tank or plane, these vital self-locking nuts go on for keeps, no matter how tough the service. Their prominent manufacturer uses 6-6-2 for the all-important tapping operation —chosen by experience over other steels for a cleaner, better job and longer life.
Vanadium-Alloys
STEEL CO. LATROBE, PA.

PARKER-KALON SOCKET SCREWS

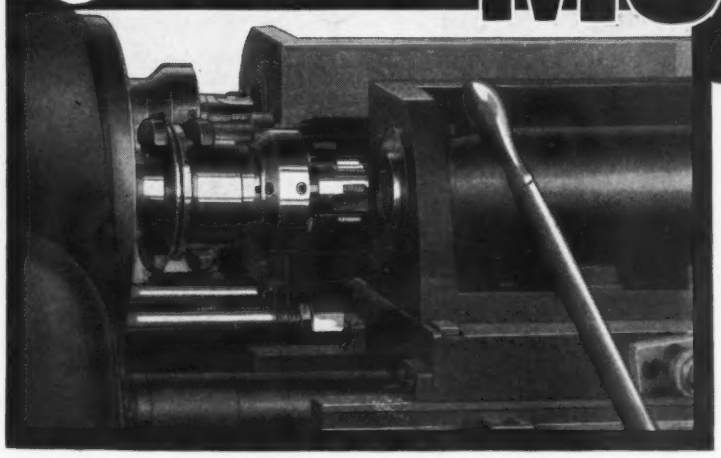
In the completely equipped Parker-Kalon Laboratories and Inspection Departments, a 16-point check up, unequalled in the industry, is made to control the quality of Parker-Kalon Socket Screws – to predetermine their performance in your assemblies – to make sure you get only those screws that can "take it."

Socket Screw users need this protection today more than ever. Specify "Parker-Kalon" next time you order . . . it costs no more.

Parker-Kalon Corporation, 202 Varick St., New York 14, N. Y.

A Product of PARKER-KALON -- Specialists in Fastening Devices

MURCHEY



No. 22 . . .
SHELL TAPPING MACHINE

● This particular machine has achieved an outstanding record in the production of shells and bombs. It is arranged with tap for tapping the nose ends of shells and bombs. May be arranged with die heads with which to thread component parts. Also equipped with lead screws to guarantee positive leads and with precision fixtures for perfect alignment. Capacity Machine Threads —½″ to 2″ U. S. S. Inclusive; ½″ to 2½″ S. A. E. Inclusive. Capacity Pipe Threads—½″ to 2″ Inclusive. Write for descriptive catalogue.

. . .

Also ask for catalogue on No. 32 and on No. 42 Thread Milling Machines.

MURCHEY MACHINE & TOOL COMPANY • DEPT. M, DETROIT 26, MICHIGAN

MURCHEY

Murchey also manufactures all types of Self Opening Die Heads and Collapsible Taps. Literature on request.

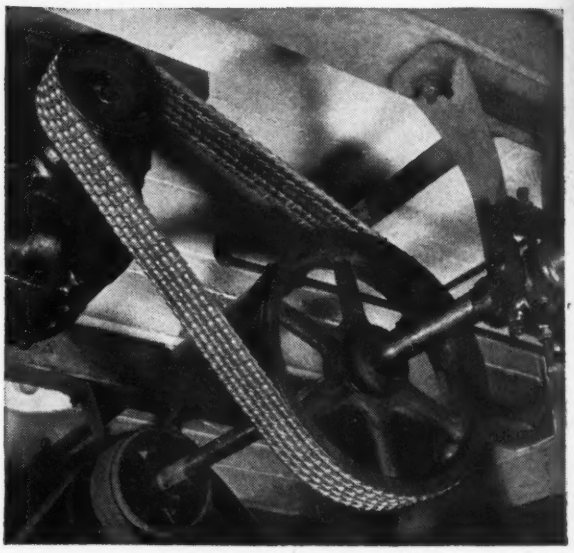
"EASE OF INSTALLATION
...SAVING OF TIME"

Put Veelos on These Drives

ASKED why he chose Veelos for lineshaft drives of a company among the leaders in its field, the Chief Engineer gave these reasons: (1) "ease of installation" and (2) "saving of time."

Thousands of Veelos installations are proving that the Chief Engineer was right because:

1. *"EASE OF INSTALLATION."* Any desired length of Veelos—the link V-belt—can be uncoupled from an economical stock roll in less than 60 seconds... and, in another minute, can be coupled endless and installed on any drive.



2. *"SAVING OF TIME."* With Veelos in rolls, V-belts can be replaced in a few minutes... reducing machine downtime.

These are just two of twelve important production advantages of Veelos. Check on the others... *write today for free 8-page illustrated manual* giving applications, construction detail, installation directions, engineering data.

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

VEELOS
THE LINK
V-BELT
ADJUSTABLE TO ANY LENGTH
ADAPTABLE TO ANY DRIVE

Teardrop cars—houses of glass and plastic are not even dreams to these people!

COURTESY NATIONAL WAR FUND

AMERICA'S postwar prosperity with employment and earnings of all who want to work, will not come from grandiose schemes of a helicopter in every back yard and every citizen happy in an ultra-modern metal and plastic home magically erected over night.

Those things may someday come true, but the *immediate* job for a postwar America will be producing to provide for the grim realities that will be faced by millions of peoples in devastated countries; it will be producing staple materials and consumer goods that folks in our own land have done so long without.

Of course, industry shall take every advantage of new materials, new techniques and processes. Up-to-date machines will be needed, too.

Surprisingly, thousands of plants in this war period *have not modernized* their metal turning departments. A lot of war production is coming off machines that were old at the start of the war. Much machinery is wearing out under constant, non-stop usage. Thousands of plants which reconvert from war work, will find their present production line machinery worn out, obsolete or inadequate.

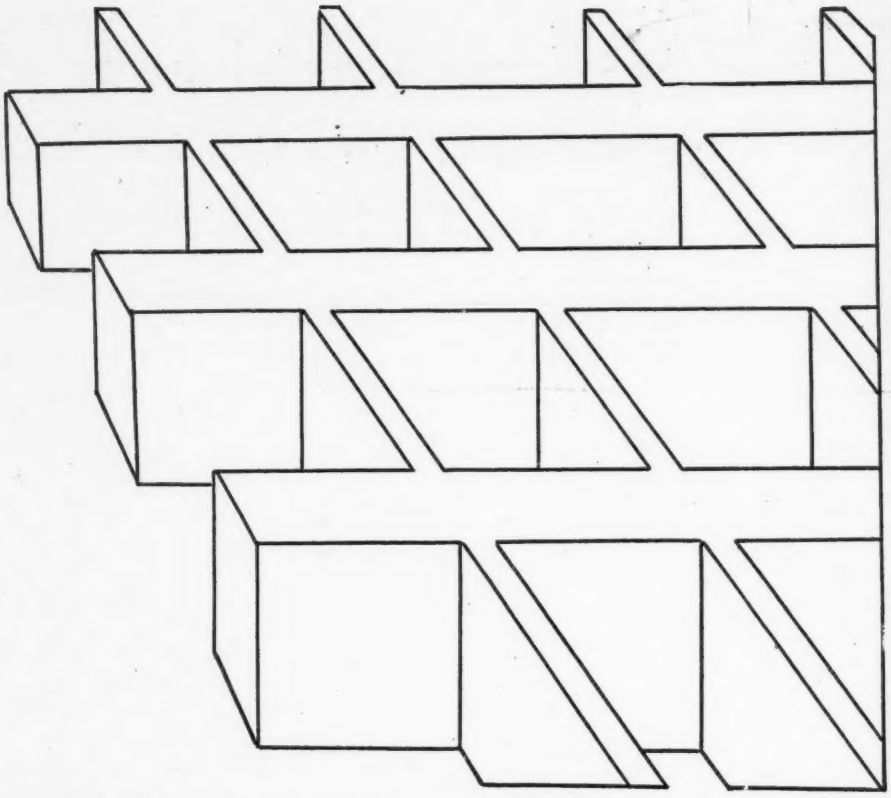
It is estimated that major industries in the United States after the war plan to spend in excess of 2¼ billion dollars for reconversion and modernization. Start planning now—don't be handicapped in postwar competition by "too little and too late".

IT IS PATRIOTIC TO PLAN NOW FOR THE POSTWAR ERA

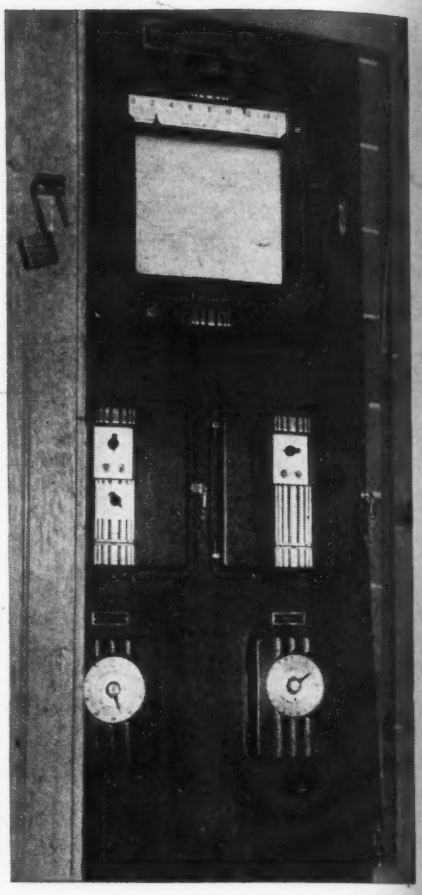
Warner & Swasey offers you practical help on postwar planning. We have a corps of engineers who are skilled in *all* machine operations involved in production of precision parts made of metal. They are helping many war plants improve methods and machines for greater production. They will continue to do so, but their services are also available to management interested in planning *now* for the future. Write

WARNER & SWASEY
Turret Lathes
Cleveland

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY



Censorship prohibits photos of the actual weldments referred to in this advertisement, but the sketch of an imaginary structure features the thick-and-thin sections of the weldments, castings and forgings to the annealing of which this new development in Micromax Control applies.



Micromax Program-Control Pyrometer for car-bottom stress-relieving furnace used by Welding Engineers, Inc., Norristown, Pa.

WARP IN STRESS-RELIEF OF INTRICATE WELDMENTS IS REDUCED BY MICROMAX CONTROL

Distortion has ceased to be a problem in several plants where intricate weldments, castings and forgings are being stress-relieved. Stress-relief is so thorough that subsequent machining is more accurate —and all these advantages are being attained in an automatically-controlled annealing cycle which is shorter than a manually-controlled one.

Reason for this success is that the Micromax Control Pyrometer strikes at the cause of distortion—which is, of course, the difference in expansion rates of the different sections of the structure. Micromax does this by using two thermocouples. One is tack-welded to the surface of a thin-sectioned element; the other to a thick-sectioned element. As the structure heats, Micromax measures the difference between the temperatures of the two sections, and when the thin one has run ahead by a predetermined value—down goes the fuel, until the thick section catches up.

On the cooling cycle the operation is reversed; Micromax operates furnace dampers to speed up or slow down the cooling rate and prevent stressing the structure.

Thus the weldment itself sets its own rate of heating and cooling, subject to the heat-treater's okay; the forces which cause stress are removed; heating proceeds at the ideally correct speed. And this speed, being based on actual measurement, is faster than a good workman could permit without the measurement, for his judgment would lead him to play safe by setting a slower rate.

This Micromax also relieves the heat-treater of holding the heating cycle, for it is a Program Controller. It compels the furnace to heat at a preset rate or rates, to soak for a preset time; to cool at a preset rate or rates. It handles temperature with the *dependability* so important in all manufacture of munitions and supplies.

If you have a specific problem, outline it and we will send specific recommendations, or we will send a catalog on request.

Jrl Ad N-33A-626(3)

depends on me!

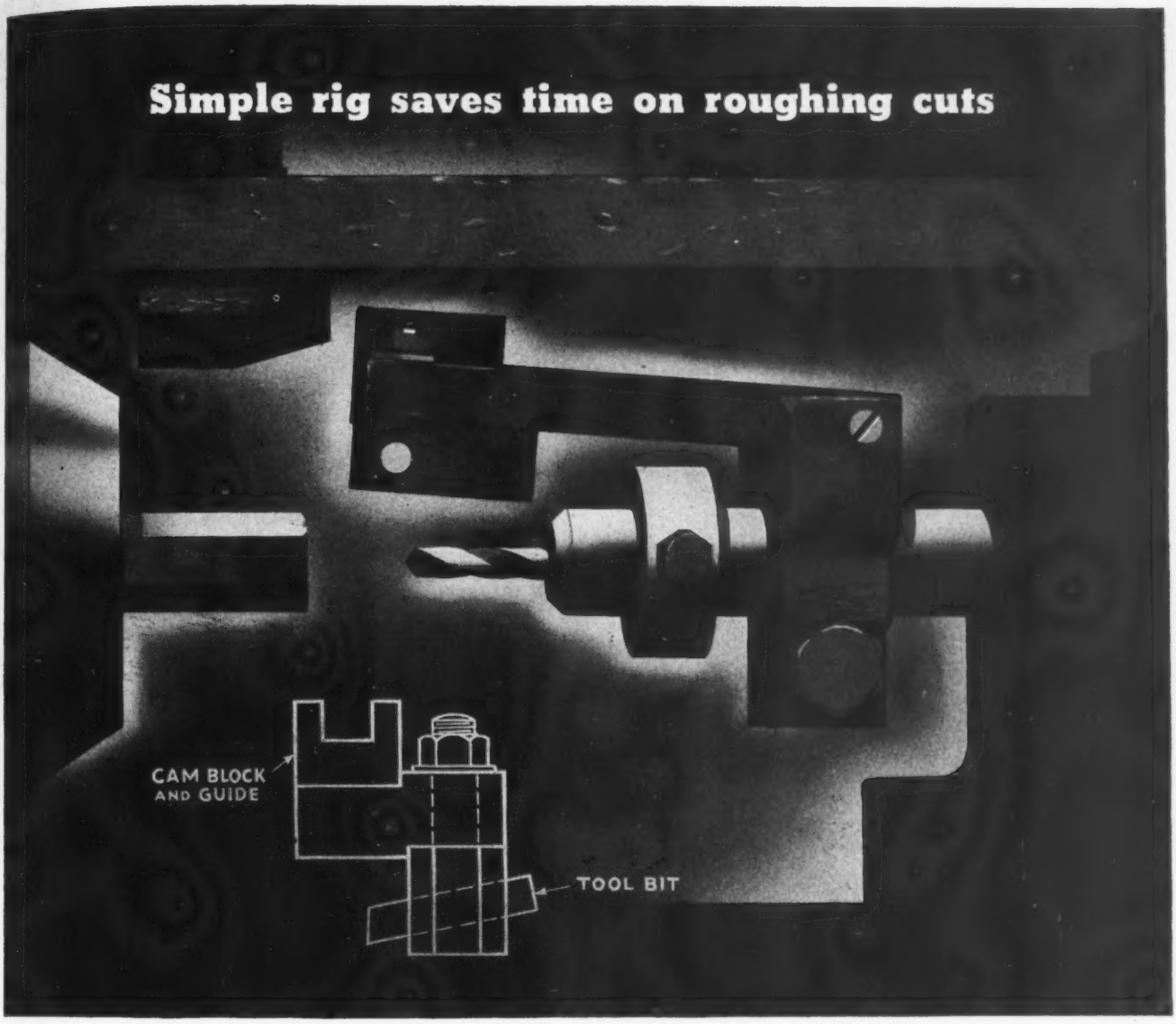
A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4921 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Simple rig saves time on roughing cuts



Information supplied by an Industrial Publication

Roughing tools conventionally mounted on turret lathes or hand screw machines have a tough time cutting hex bar stock. Intermittent cutting, accompanied by successive severe shocks make frequent resharpening necessary. This means equally frequent machine shutdowns.

The problem of eliminating the lost time on such jobs has been solved in a New England plant by an ingenious rig applied to some old turret lathes.

The rig consists essentially of two bars. One, carrying the roughing tool, is pivoted to the turret. The other, having a very simple adjustable cam on its lower side, is fastened between the top of the turret and a sliding support on the headstock.

As the turret advances the roughing tool, the cam feeds it downward, then guides it horizontally and supports it transversely while the roughing cut is made. A drill or other inside tool may be fed in to work simultaneously.

When the roughing cut is finished, the tool is backed off, and the finishing tool fed in on the cross slide. When the roughing tool needs resharpening, it is simply a matter of a few minutes to take it out of the holder and put a sharp tool in. Shutting down is unnecessary. There is less need for expert grinding and resetting.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

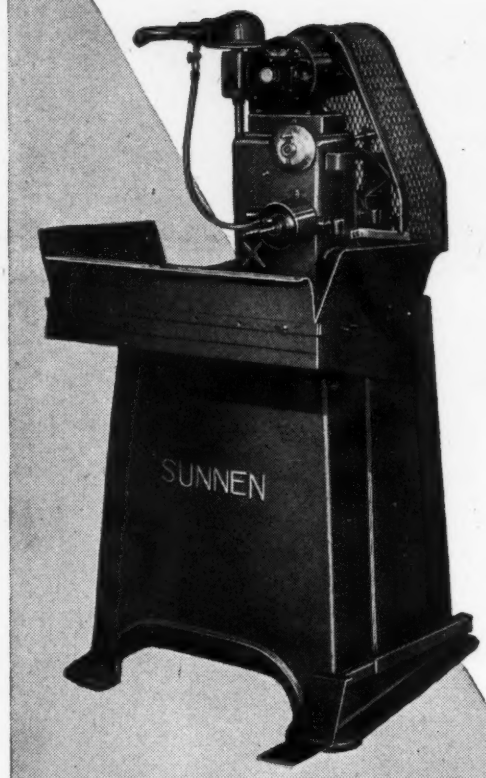
Climax Molybdenum Company

500 Fifth Avenue · New York City

MOLY

More Accurate Internal Finishes

in Less Time at a Lower Cost—With the Sunnen Precision Honing Machine



This popular, low-cost machine is guaranteed to hone internal cylindrical surfaces to within .0001" and produce a super-smooth finish of 2 to 3 micro-inches. In actual practice, *accuracy has been held to within .000025" on production jobs.*

In addition, production has been increased — *in some instances up to 500%* — with fewer rejects and absolute interchangeability of parts. These advantages not only speed production but prevent waste of vital war materials and costly man-hours of production!

Consider These Advantages, Too

Wide range — the Sunnen Precision Honing Machine handles internal diameters from .185" to 2.625". Relieves big internal grinders for other jobs. Corrects errors of out-of-roundness or taper caused by previous operations. Facilitates duplication of sizes. Does not require skilled labor. Practical—inexpensive — economical to operate.

Write for free bulletin—or ask a Sunnen Engineer to give you complete information on how Sunnen Honing can be put to work in your plant.

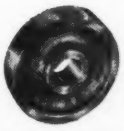
Typical Jobs

Cast Iron Valve Stem Guide. ½ to one thousandth removed —220 pieces per hour. Better finish and straighter hole.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.

Idle Valve Guide. Honing after grinding holds a .0002" limit necessary for accurate idling.

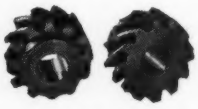
Shell Loading Die.



Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Hydraulic Control Bushing. Honing gives straight round hole after rough reaming.

Aircraft Carbureter Operating Valve Sleeve. Sunnen honing eliminates distortion from assembling operation.



Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Compressor Yoke. Alignment maintained and better finish produced.

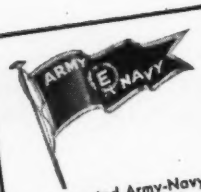
Mild Steel Clevis. Honing corrected errors of previous operations and maintained true alignment of two holes.

Roller Bearing Outer Race. Finish improved from 12 micro-inches to 2 micro-inches.

Bearing. A very small part. 2 micro-inch finish necessary.

Carbureter Idler Pump. Smooth, straight-line finish in blind hole prevents piston leakage.

Ceramic Insulator. Honing used to eliminate roughness inside ceramic tube.

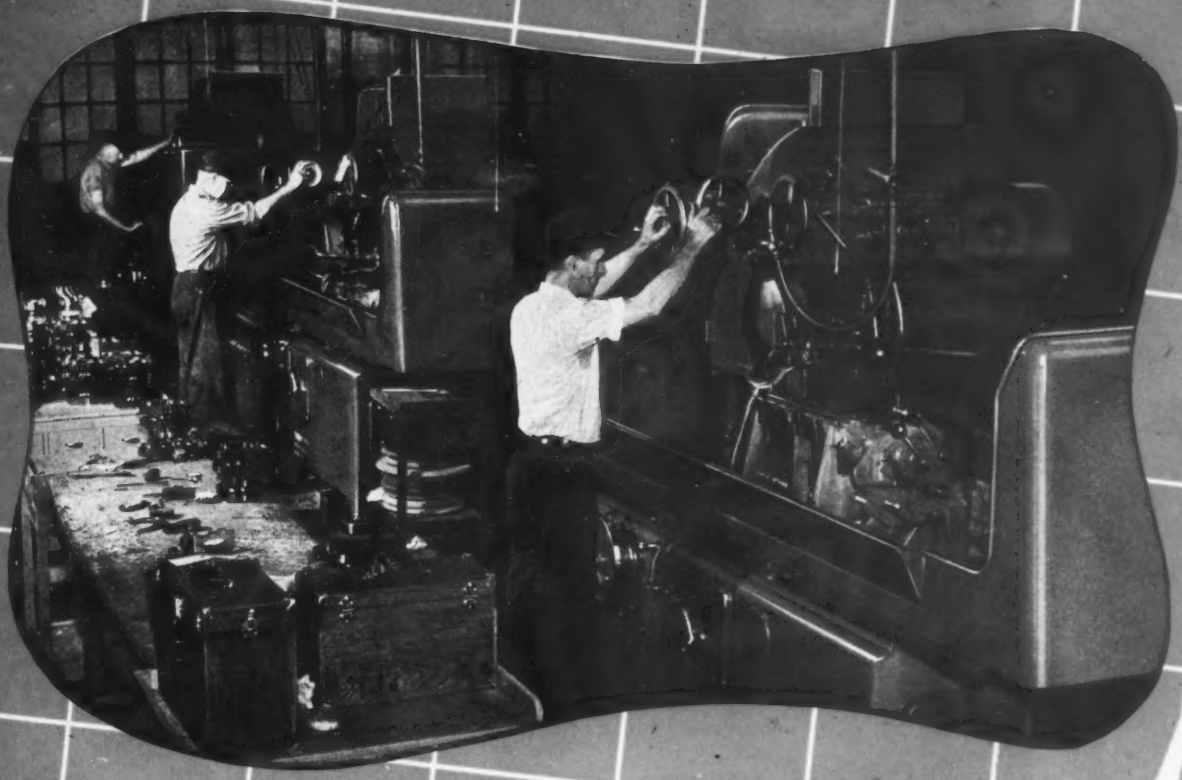


The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

SUNNEN

SUNNEN PRODUCTS COMPANY 7940 Manchester Ave., St. Louis, Mo.

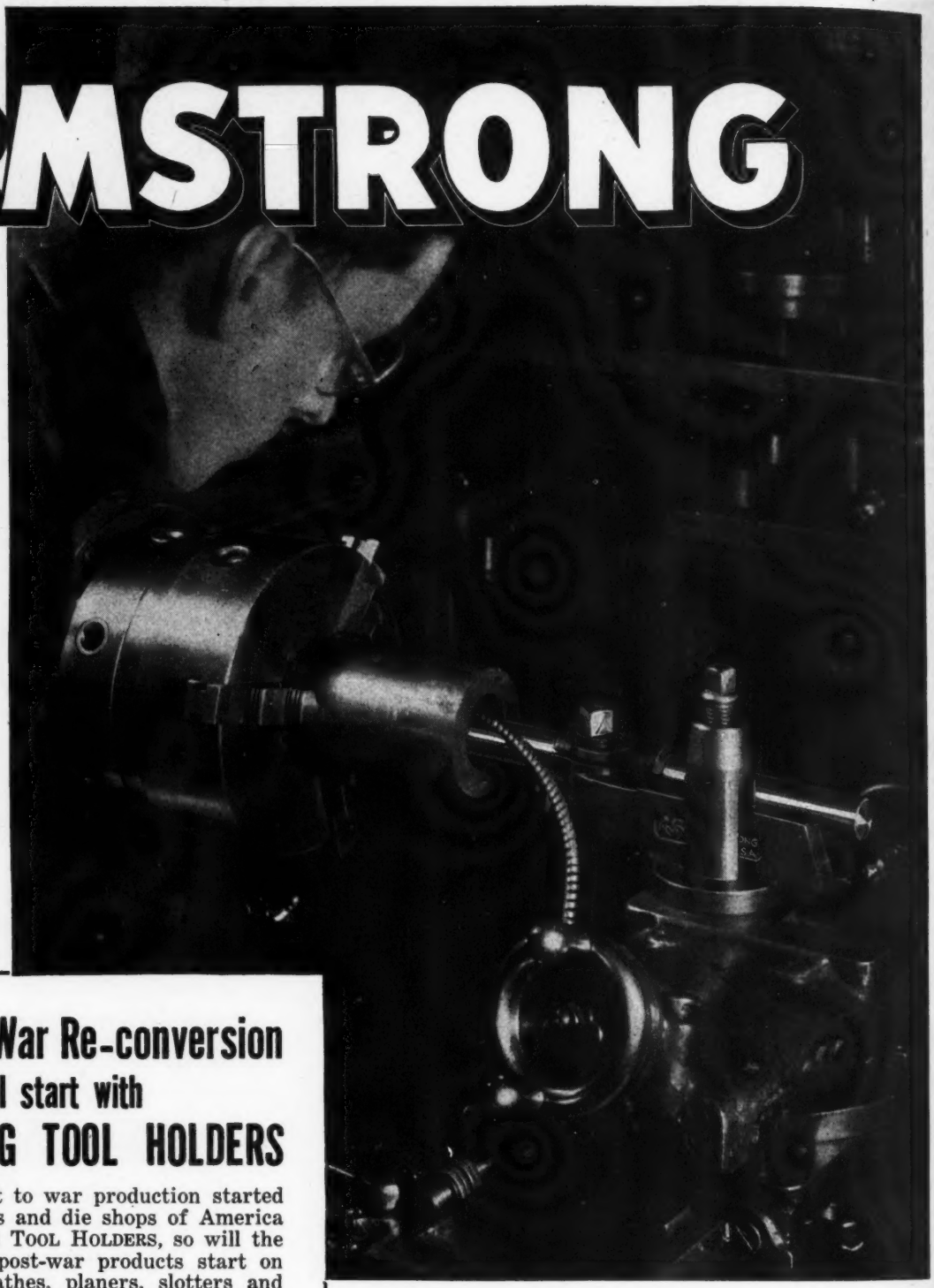
Canadian Factory, Chatham, Ontario



"Thompson" to step UP production

The number of war plants using Thompson Grinders is an indication of the value of these machines in raising production curves. In fact, the entire line of Thompson Grinders is streamlined for high speed and ultra precision. In aircraft work particularly — as illustrated by the photos on this page showing a battery of Thompson machines producing master and articulated rods for aircraft engines, and a detailed view of the setup — Thompson Grinders are helping many manufacturers to keep in step with extreme output demands, and at the same time meet today's exceptional quality-workmanship requirements. The full hydraulic action of any Thompson Grinder insures smoothness and precision, superior finishes, closer tolerances. For your sensitive, stepped-up war production, LOOK TO THOMPSON! Write for details to The Thompson Grinder Company at Springfield, Ohio.

ARMSTRONG



Your Post-War Re-conversion will start with ARMSTRONG TOOL HOLDERS

Just as the shift to war production started in the tool rooms and die shops of America with ARMSTRONG TOOL HOLDERS, so will the reconversion to post-war products start on the tool room lathes, planers, slotters and shapers. Now is the time to equip each of these machine tools with its full complement of ARMSTRONG TOOL HOLDERS. They will enable you to increase production of War Material NOW, for with the correct ARMSTRONG TOOL HOLDER for each operation you can step up speeds and feeds (often double hourly output) safely and without loss of cutting efficiency. Then too, when the war ends you will be tooled-up for every operation, ready to start *instantly* on re-converting your plant to post-war production.

Write for Catalog today

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
313 N. FRANCISCO AVE. CHICAGO, U.S.A.

Eastern Warehouse and Sales:
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

NOW READY FOR YOUR USE!

NEW U. S. OFFICE OF EDUCATION 16 MM. MOTION PICTURES

For increasing Worker Skills in Critical WAR JOBS!

IMMEDIATELY AVAILABLE ON MACHINE SHOP WORK!

(Order No.)

179. The Slide Rule
56. Cutting an Internal Acme Thread
62. Using a Steady Rest
63. Using a Follower Rest
90. Sharpening a Side Milling Cutter
91. Sharpening a Plain Helical Cutter
92. Sharpening a Shell End Mill
93. Sharpening a Form Relieved Cutter
94. Sharpening an Angular Cutter

Many more subjects on machine shop work, now in production, will be ready soon!

ALLIED SUBJECTS READY!

While listed under specific industries, these films are so basic that they can be used wherever machine shop work is vital.

AIRCRAFT WORK

128. Sawing Template Metal
129. Filing Template Metal
130. Blanking Sheet Metal on the Squaring Shear
131. Blanking Sheet Metal with Hand Snips
135. Finish Forming by Hand
142. Tube Bending by Hand

SHIPBUILDING SKILLS

105. Measuring Pipe, Tube, and Fittings
106. Cutting and Threading Pipe by Hand
107. Cutting and Threading Pipe on a Power Machine
108. Making a Cold Bend on a Hand-Powered Machine
109. Covering Hot and Cold Pipes

Also farm work subjects of value to industry! Send for complete details NOW!

THE FIRST of many new U. S. OFFICE OF EDUCATION training films are now ready for your use.

These new films cover occupations approved by the War Manpower Commission as those requiring FIRST attention. The subjects are so basic that they will prove valuable to practically any industry.

To increase the effectiveness of the new program, you now have available *tested* "show how" units consisting of a sound motion picture, an instructor's manual, and a silent film strip *for each subject covered.*

Partial list of films now available is shown at left. Many other subjects are now in production. They will be ready soon. To obtain full details on these—and forthcoming subjects—send the coupon below TODAY!

Put all films that you can use to work immediately!

CASTLE FILMS INC.

Distributor for

THE UNITED STATES OFFICE OF EDUCATION

CASTLE FILMS, INC.

RCA BLDG.	FIELD BLDG.	RUSS BLDG.
NEW YORK 20	CHICAGO 3	SAN FRANCISCO 4

Address nearest office

Please put us on your mailing list to receive complete information on U. S. OFFICE OF EDUCATION worker-training films.

*Company*_____

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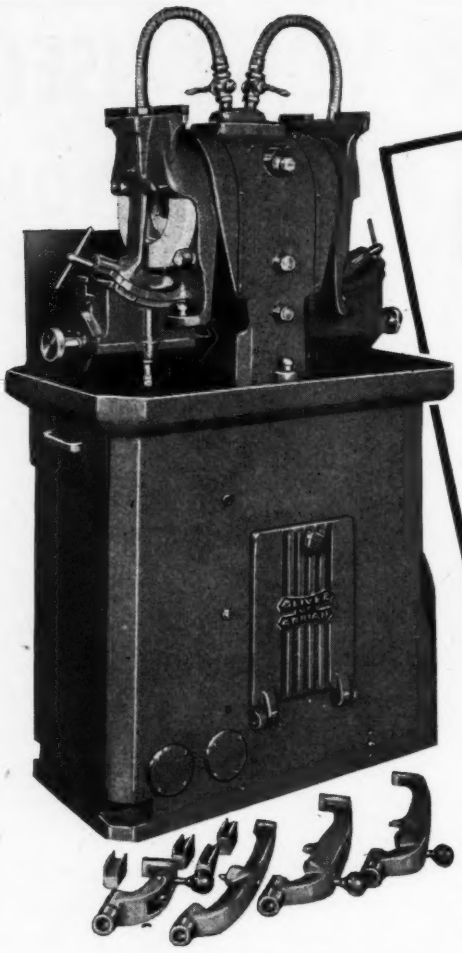
*State*_____

*By*_____

MA-2-44



ACCURATE UNIFORM SINGLE POINT TOOL GRINDING

THE OLIVER TEMPLATE TOOL BIT GRINDER

Machine performance can be no better than the tools that do the cutting! Keep your single point cutting tools in condition for maximum war production efficiency with the **Oliver Template Tool Bit Grinder.** Using a master template, this Oliver Grinder produces correct top rake, accurate clearances and sharp cutting edges, assuring uniform results entirely independent of the skill of the operator. Heavy, rigid and vibrationless, it can grind carbide and other high speed tools rapidly and accurately.

No single factor is more important in maintaining the efficiency of a machine than the keenness of its cutting tools. Keep them uniformly accurate and free cutting and they'll be able to handle today's high pressure war production with economy, speed and accuracy. Used extensively in the Aircraft industry on special tooling for Propeller production. Also by many Cutting tool manufacturers.

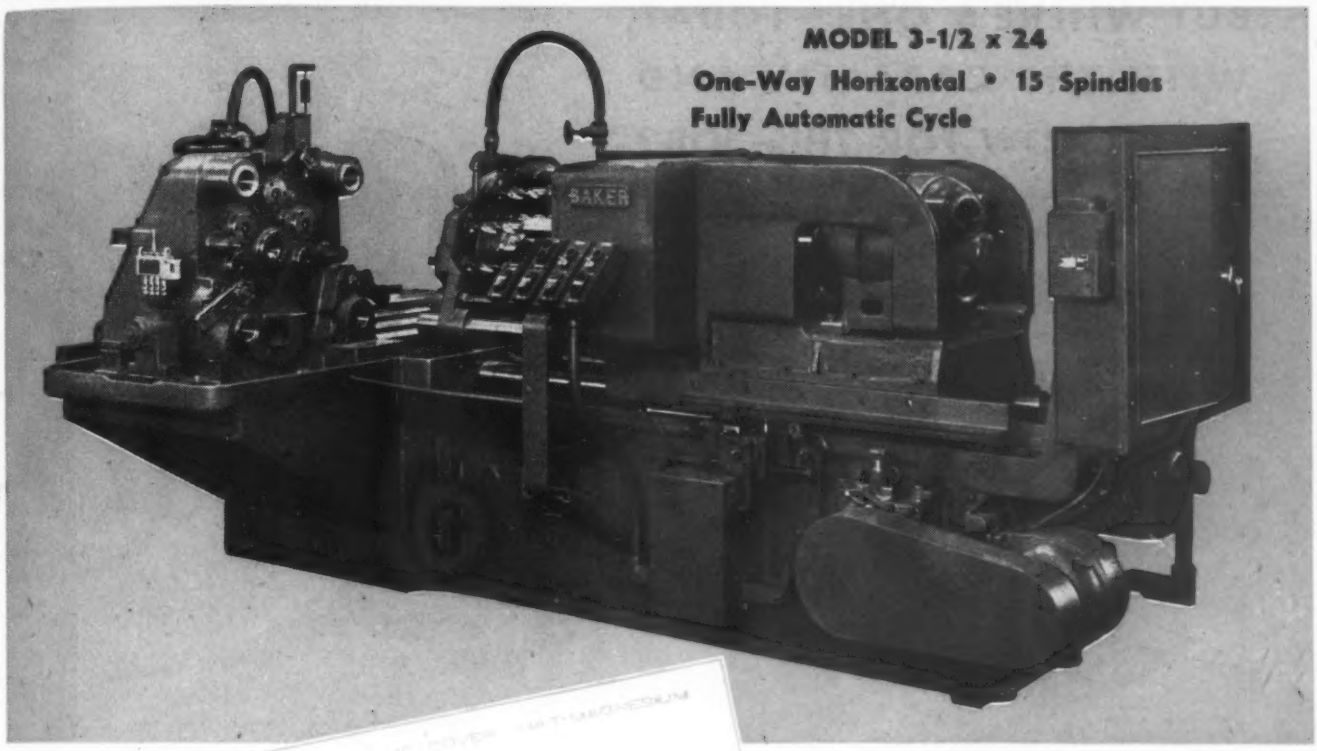
Don't Neglect Your Toolroom It's the Backbone of Production!

OLIVER INSTRUMENT CO.
1410 E. Maumee St. Adrian, Mich.

Oliver
OF ADRIAN

AUTOMATIC DRILL GRINDERS — TOOL AND CUTTER GRINDERS — DRILL POINT THINNERS — TEMPLATE TOOL GRINDERS — FACE MILL GRINDERS — DIEMAKING MACHINES

Another BAKER Contributes to Current High Aircraft Production



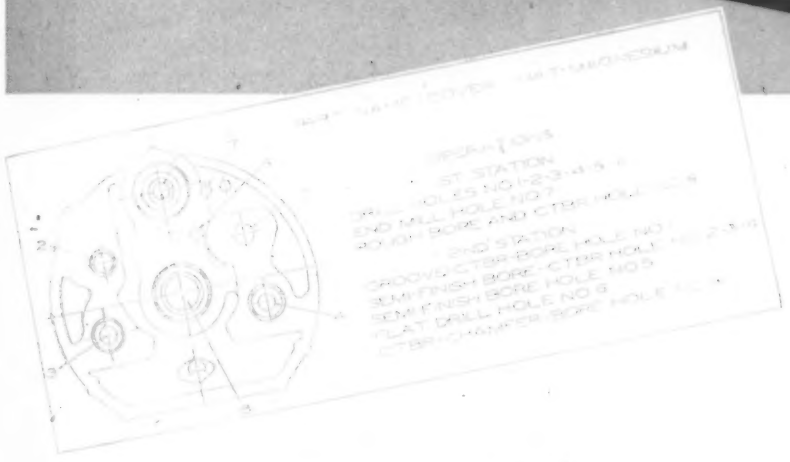


ILLUSTRATION shows the Fixture to front at Chucking Position. The operator loads, unloads, and pushes button to start cycle.

Fixture and work automatically index to 1st (Front) Position (8 spindles) for drill and rough bore.

After this operation, Fixture moves to rear position (7 spindles) for finishing operations. Then, an automatic return to Chucking Station.

Baker Brothers, Inc.
Toledo 10, Ohio

BAKER

FOR SINGLE AND MULTIPLE SPINDLE DRILLING MACHINES, VERTICAL AND HORIZONTAL TYPES

"Now all we need is a Good Contract Manufacturer

...BUT WHERE'S ONE* TODAY WITH THE CAPACITY AND KNOW-HOW FOR THIS JOB?"

IF you're up against it for manufacturing capacity to produce a badly needed part, machine, or mechanism . . . then wrap up your headache and *Take It To Taft-Peirce.* Here, in the Contract Division, your production requirements will be filled promptly and economically . . . exactly according to your blueprints, specifications, or models . . . regardless of whether your order calls for a single piece or quantity lots.

For here, in this unique organization, you will find a collateral fund of experience in the manufacturing practices of your own industry . . . because there is *no* industry which has not brought its problems to Taft-Peirce. So there is no delay in getting down to brass tacks on any assignment.

Examples of work done, and of the men and machines which do it, are shown in an interesting picture-and-caption book which you may have for the asking. Simply write, on your letterhead, to *The Taft-Peirce Mfg. Co., Woonsocket, R. I.,* for a copy of the publication entitled:

***TAKE IT TO TAFT-PEIRCE**

ALLOY TIPPED TOOLS

FOR HIGHER SPEEDS

• Where cutting speeds must be increased to keep pace with modern methods, Scully-Jones and Company standard tungsten carbide and Haynes Stellite tipped tools effect substantial savings by increasing production, giving better finish, longer tool life with less regrinding, and lower cost per unit produced.

Years of experience and engineering knowledge assure correct grades of alloys for your particular job. Our facilities provide prompt and dependable service.

Kindly send drawings or specifications for quotations on special tools.

Scully-Jones
AND COMPANY

1901 SOUTH ROCKWELL STREET ★ CHICAGO, U. S. A.

Precision in Wartime — Finishing diesel engine pistons for battleships

In 1944

LET'S WORK FOR VICTORY

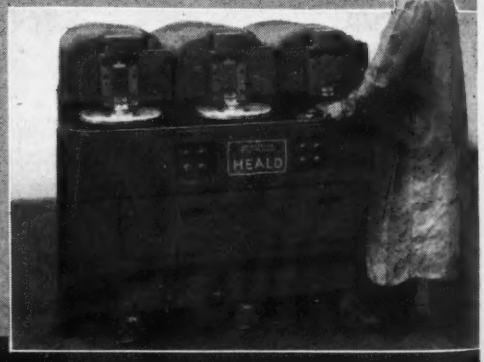
Only reconversion planning NOW can avert the widespread unemployment otherwise inevitable in the period between cessation of war production and resumption of peacetime production. Not that we have won the war, we haven't, and a long, desperate battle lies ahead. Even so, every bit of postwar planning done now will help in far greater ratio, when V-Day comes, to provide for the stricken people of a ravaged world, in putting our demobilized soldiers and war workers back to work on useful jobs.

If your postwar plans include precision finishing, HEALD ENGINEERING is available, now. Long and varied experience in solving countless problems in precision boring and grinding in consumer and heavy industries, plus our undiminished present efforts in war production, can be immensely helpful. We'll be glad to work with you.

But Plan For Peace

THE HEALD MACHINE CO., Worcester, Mass.

Postwar precision operations will include Heald Bore-Matics like this for facing automotive flywheels.



In 1944 we have the most tremendous shortage of goods this world has ever known must be satisfied — by you and your competitors. Planning now for postwar production will eliminate many bottlenecks later — and if problems involve precision Heald will gladly cooperate in their solution. Although our staff of 250 engineers are engaged on war problems, their experience in finishing peacetime products from automobiles to sewing machines is also available to help in your postwar planning.

In 1944

for More Precision Faster, bring your problem to Heald

Way back in the relatively calm days of '39, the Molded Products Company of Chicago were making radio cases for the pleasure of ordinary citizens. In May of that year they equipped one press with steam connectors of American Flexible Seamless Tubing. In September they equipped two more presses. In March 1940, under the pressure of war contracts, they equipped additional presses. And in July 1942, with the plant on 100 percent war production of helmet liners and plastic wheels for hand trucks, the remaining presses were given the added security of these steam-tight, free-moving, long-lived connectors.

The experience of the Molded Products Company is but one more instance of American Metal Hose going in on trial . . . *and coming out on top.* Wherever a practically indestructible, flexible, air-tight conveyor is required, for oil, gas, or water; for vacuum service or for protecting electric wiring, American Flexible Metal Hose and Tubing are providing reliability and economy.

44191

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY

Subsidiary of Anaconda Copper Mining Company

General Offices: Waterbury 88, Connecticut

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

ANACONDA

American Metal Hose

Don't let this Cut-off Blade fool you - - it CAN be used on Your screw machines*

Specially designed holders are available for all standard makes

Are you one who has said "I can't use this blade. How could I put it on my machine?" Mister, you have been missing something! Don't deprive yourself of the advantages of this cutting-off blade another day. Convert down time into productive time.

Here's Why EMPIRE TOOL COMPANY'S CUTTING-OFF BLADES and HOLDERS are increasing production in leading plants of the country

LUERS PATENTED

FEATURES OF BLADES

T-shaped design provides proper clearances where necessary, eliminating excessive friction.

Two types available—parallel (P-series) or tapered (T-series) to longitudinal cutting width. Parallel blade is used mostly for shallow cut-offs and grooving—tapered type provides back clearance full length of blade and eliminates excessive friction.

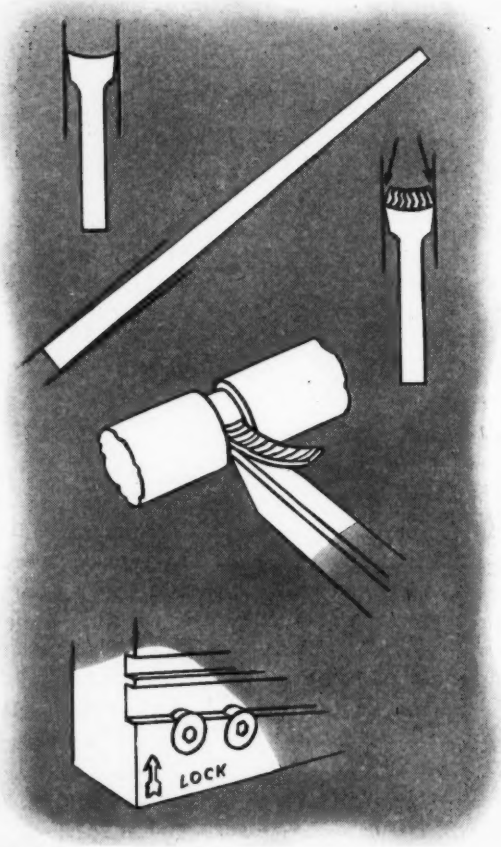
Hollow-ground top causes chip to collapse and relieve friction against sidewalls.

Collapse of chip permits coolant to reach cutting edge of blade. Friction reduced; life of blade extended.

**Blades and Holders can be used on following machines:*

Acme Gridley	Libby
Bardons & Oliver	Midland
Brown & Sharpe	Millholland
Cleveland B Vertical	Morey
Cone Automatic	National Acme
Davenport	New Britain Automatics
Foster	Simmons
Gisholt	South Bend
Greenlees	Warner & Swasey
Gridleys	

Send for complete catalog.



FEATURES OF HOLDERS

ACCESSIBILITY — Blade can be easily removed for resharpening and replaced without disturbing original setup.

DURABILITY—Holders are made of finest nickel steel. Cams of chrome nickel.

ECONOMY—Holders continue to grip blades until their size is reduced to within an inch of original length.

EFFICIENCY—Holders give blades proper rake to produce free cutting action. Eliminate hand grinding of lip on top of blade.

RIGIDITY—Two developed cams grip blade so securely no chatter or vibration are possible.

SIMPLICITY— Holders adaptable to machines without requiring alterations to machine or tools.

BUY WAR BONDS

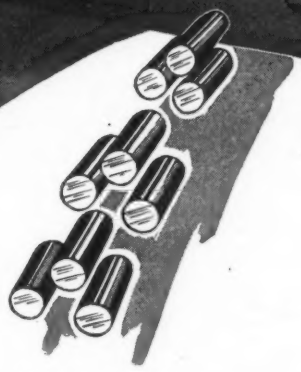
EMPIRE TOOL COMPANY MANUFACTURES LUERS PATENTED CUTTING-OFF BLADES AND HOLDERS UNDER LICENSE ISSUED BY JOHN MILTON LUERS PATENTS, INC.

The Blades That Reduce Friction

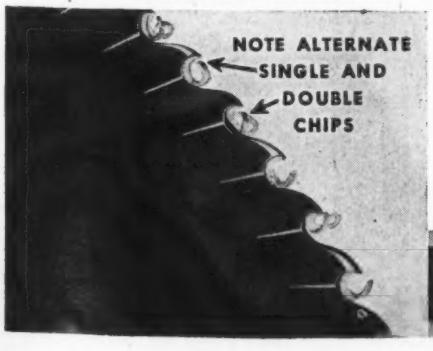
EMPIRE Tool Co.

8786 Grinnell Ave.
Detroit 13, Mich.

THE MOTCH & MERRYWEATHER No. 3 *Multiple Bar* COLD SAWING MACHINE ILLUSTRATES WELL THE *Exclusive* *Triple-Chip* METHOD



Only the Motch & Merryweather Cold Sawing Combination (saw, blade and sharpener) gives you the advantages of the Triple-Chip method.



MULTIPLICATION is the rule of war. Three bars had to "grow where one grew before". The Motch & Merryweather Multiple Bar Cold Sawing Machine was developed for this purpose. Essentially, it is a No. 3 standard machine to which a special fixture and a pedestal-type conveyor have been added. The results have been remarkable.

The No. 3-M illustrates the Triple-Chip method at its best. You get sharp, clean cuts, with square ends, without draw or burr or chatter, and without scrap. Operators like the unusual convenience, ease of handling, and safety. All this, with eye-opening speed.

Perhaps *your* work is *non*-ferrous. We offer you, not only the general-purpose type for iron and steel, but also the non-ferrous type for aluminum, brass, bronze, and magnesium. We offer you, too, the Motch & Merryweather segmental type saw blade and saw blade sharpening machine. *Only Motch & Merryweather builds "all three".*

THE MOTCH & MERRYWEATHER MACHINERY COMPANY
Penton Building · CLEVELAND 13, OHIO

Built by **MOTCH & MERRYWEATHER**

MOTCH AND MERRYWEATHER MACHINERY CO
CLEVELAND CINCINNATI DETROIT PITTSBURGH

Announcing

THE CHANGE IN OUR CORPORATE NAME

from

THE LINCOLN PARK TOOL and GAGE COMPANY

to

LINCOLN PARK INDUSTRIES
INCORPORATED

The Management, Personnel and Policies of the Lincoln Park organization remain unchanged

THE MERGER OF

CARBUR, INC.

Manufacturers of Solid Cemented-Carbide Rotary Files and Cutting Tools

with

LINCOLN PARK INDUSTRIES, INC.

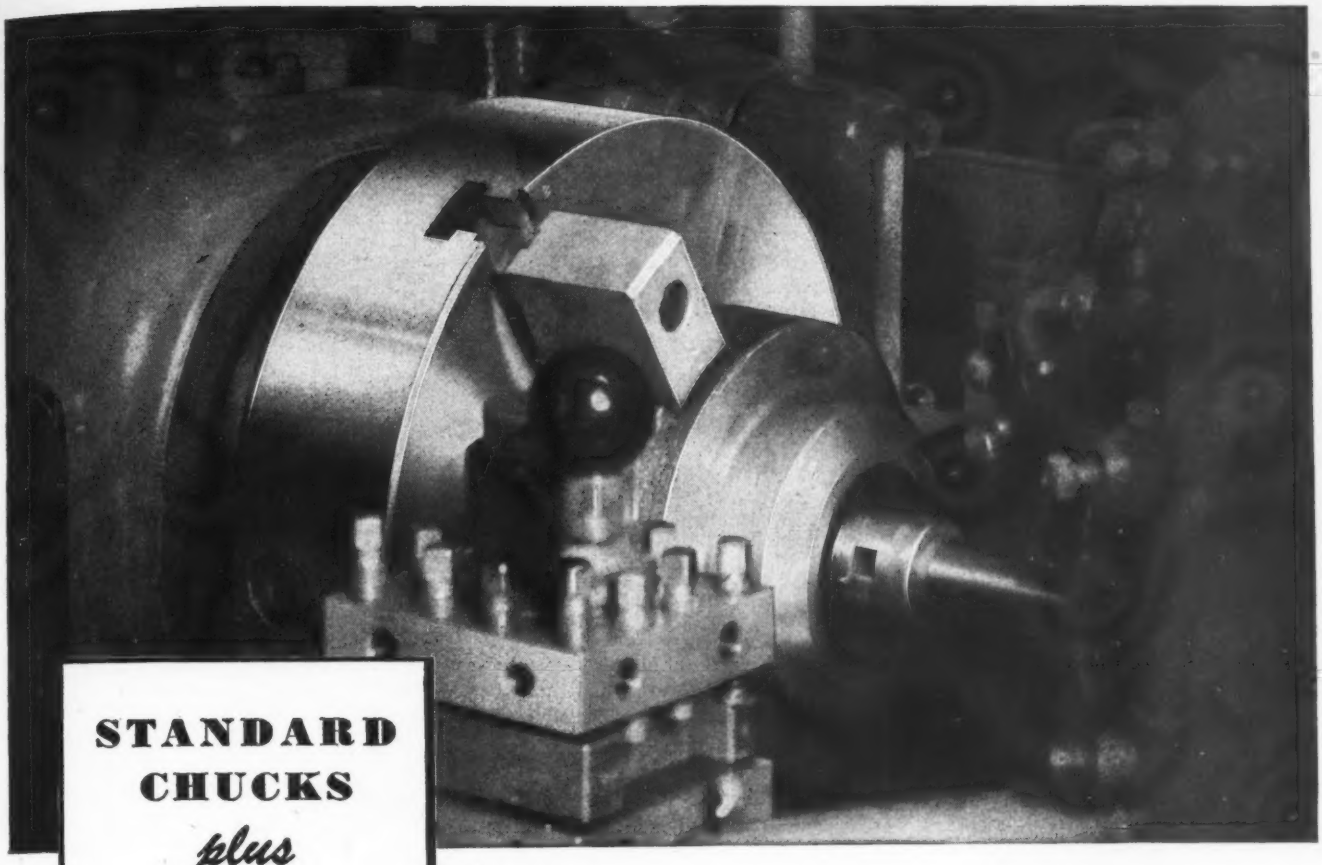
The name "Carbur" will continue to identify the tools formerly manufactured by Carbur, Inc. However, future production will be handled as a departmental operation of Lincoln Park Industries, Inc.

☆ A star has been added to our Army-Navy "E" flag. In making this award, Robert P. Patterson, Under Secretary of War, writes, "You have continued to maintain the high standards that you set for yourselves and which won you distinction more than six months ago."

ARMY E NAVY

LINCOLN PARK INDUSTRIES, INC.

Successor to LINCOLN PARK TOOL AND GAGE COMPANY
LINCOLN PARK 25, MICHIGAN



STANDARD CHUCKS *plus* SOFT BLANK JAWS

..SAVE *while they* SOLVE *tough set-up problems*

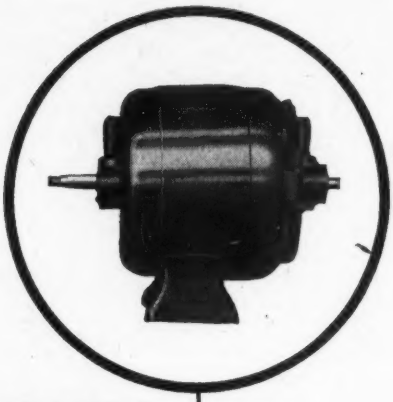
WITH the development of the American Standard two-piece jaw construction, it became very easy to hold work of unusual shapes or dimensions in standard chucks simply by machining a set of soft blank top jaws to the required form. This saved a great deal of the time and material previously put into construction of special work-holding devices and also made it possible to quickly change a machine over from one job to another by merely exchanging the removable top jaws in the chuck.

This is typical of the time and material saving short cuts that... in a thousand little ways... have enabled American Industry to out-produce our enemies before they thought we could get started. They are going to help make reconversion to civilian production equally successful.

Let Cushman work with you on present and future work-holding problems... and in the interests of Tool Conservation. The Cushman Chuck Company, Chucking Engineers Since 1850 Hartford 1, Conn.

A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS



*SPECIAL MOTORS DESIGNED TO FIT THE APPLICATION

A MILLION STARTS AND STOPS

To prevent intricate mechanisms from skipping figures, electric motors for calculators, electric typewriters, cash registers and tabulating machines must provide constant speed and must make millions of starts and stops . . . without requiring repairs or replacements during the life of the equipment.

Many different types of office machines are powered with Holtzer-Cabot motors designed especially to meet these conditions. Manufacturers of many other kinds of products from instruments to meat grinders have found that special fractional HP motors built by Holtzer-Cabot, improve operation and increase the saleability of their products, and reduce maintenance problems.

If you are designing or building post-war products which will require fractional HP motors, our engineers, backed by 68 years of experience in special motor design, would like to talk with you about your motor problems. There is no obligation.

THE HOLTZER-CABOT ELECTRIC COMPANY

Designers and Builders of Special Fractional HP Motors and Electrical Apparatus

125 AMORY STREET, BOSTON 19, MASS. CHICAGO, ILL., NEW YORK, N.Y., PHILADELPHIA, PA.

FILLING A LONG-FELT NEED—

DAYTON ROGERS *Model C* PNEUMATIC DIE CUSHION

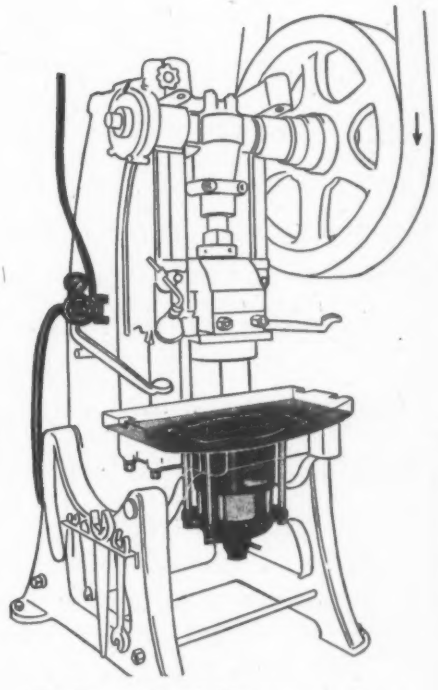
—the NEW and BETTER Die Cushion that assures accurate, adjustable working pressure on all Dies!

Accurate, adjustable working pressure in place of springs or rubber on dies already in use, with the new DAYTON ROGERS PNEUMATIC DIE CUSHION.

The Die Cushion is completely self-contained, can be quickly and easily mounted directly on the bolster plate of practically any make of power punch press. It has a wide application—is not limited to controlling the draw-ring on *deep-drawing* operations but can also be used for controlling the pressure pad on a large percentage of *forming dies*. Design and mounting eliminate pin pressure pad deflection, and the pin pressure area is increased to the maximum capacity of the press bed opening, thanks to the all-hardened and ground pin pressure pad that can be machined and fitted to press bed opening of the individual press used.

An unusually wide range of sizes is available, from 4″ to 24″ (die cushion piston sizes), with a drawing capacity from 1″ to 12″, and developing ring-holding pressures from 1½ to 23 tons. Equipment includes combination reducing regulator, valve, and pressure gage, together with high-pressure hose fittings that facilitate quick and easy installation.

Send for full specifications, prices, etc.



Easily and quickly mounted on all presses

DAYTON ROGERS MFG. CO.
2835 12th Avenue South **MINNEAPOLIS 7, MINNESOTA**

AFTER V *what?*

TO win this war, as quickly and as decisively as possible, is the aim and the job of all of us. That goes without saying. But after Victory—what? No one knows the answer to that question. But most concerns now turning out war goods are doing the thinking and the planning so vital to arriving at the right answer.

★ In the change-over from the making of war essentials to peacetime commodities those methods and materials that have stood the acid test of war production will continue to be used wherever possible. Some materials, because of their inherent characteristics, should, indeed, find greatly enlarged fields of usefulness.

★ Take Kirksite "A"* for example. Here is a versatile alloy used for making dies for stamping and forming light sheet metals, plastic, fiber, paper or composition parts and objects. Used by practically all warplane makers, Kirksite "A" has played an important part in stepping up production speed and lowering production costs.

★ Specifically, Kirksite "A" has (a) excellent casting properties; (b) good resistance to abrasion; (c) is readily adaptable to welding operations; (d) is easily polished and machined; (e) exhibits physical properties approaching those of mild steel.

★ Manufacturers of such items as special auto or truck bodies, housings and parts for household appliances, metal furniture, cooking utensils, electrical equipment, toys and novelties, etc., will, in using Kirksite "A", enjoy the advantage of flexibility in designing because of the low cost and rapid production of trial dies. Customer reaction to experimental designs can be obtained without building costly steel tools to produce them.

★ With an eye to post-V production, Kirksite "A" is well worth considering.

LIMITED AMOUNTS OF KIRKSITE "A"

are available for certain experimental purposes. Under a special ruling by the War Production Board, we are permitted to make limited sales of Kirksite "A", without priority, for a specific purpose. Concerns now unfamiliar with this alloy, who wish to purchase a limited amount for dies to be used in experimental work, should address their inquiries to Kirksite Dept., National Lead Company, 111 Broadway, New York 6, N. Y., stating clearly the use to which the alloy will be put.

NATIONAL LEAD COMPANY

111 BROADWAY NEW YORK 6, N. Y.

Branches in all principal manufacturing centers.

Trade Mark Reg. in U. S. Pat. Off. by Morris P. Kirk & Son, Inc., Los Angeles, a subsidiary of National Lead Co.

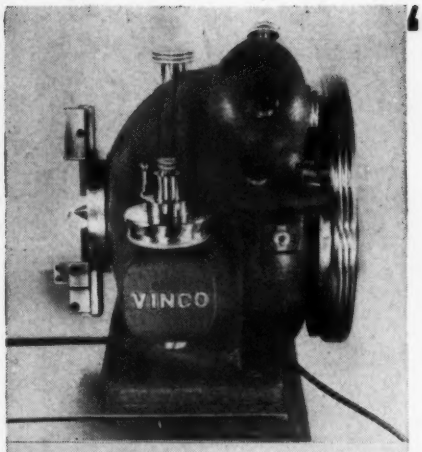
Precision Built Milling Machines Since 1858

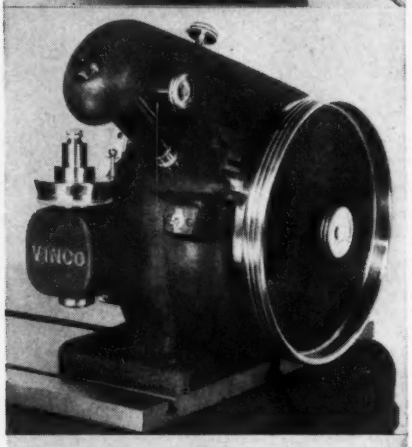
KEMPSMITH

KEMPSMITH MACHINE COMPANY • MILWAUKEE 14, WIS., U. S. A.

Shall our younger generation fight with gloves or machine guns . . . against a friendly neighbor or a deadly foe . . . in peaceful, back-yard surroundings or in blood-drenched battle fields? The answer depends on what YOU and I do on the production front. We must CONTINUE to produce vitally needed war equipment and supplies . . . in ever increasing amounts . . . to help the United Nations win the War. We dare not let them down. We must

STAY ON THE JOB!





"30 times more accurate"

For the past few years we at Vinco have been producing the Optical Master Inspection Dividing Head using the finest material and the best possible methods and workmanship in its production. We are informed, on high mathematical authority, that our Dividing Head is thirty times more accurate than others being used in inspection. The spindle in each instrument is carefully inspected and checked. The spindle run-out is guaranteed to within twenty-five millionths of an inch, total indicator reading; the average run-out however being approximately fifteen millionths. The Dividing Head is guaranteed accurate to within two seconds of arc, but experienced inspectors are able to match the lines viewed through the microscope to within 12½ millionths of an inch or ½ second of arc. It can therefore be seen that this Dividing Head operated properly is capable of great accuracy. Send for our folder.

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8853 SCHAEFER HIGHW'Y
DETROIT 27, MICH.

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Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline. Serration Spline. Involute Spline and Helical Spline Plug and Ring Gages • Thread Ring Gages and Masters • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development

MILLING CUTTERS • BROACHES • FORM TOOLS • END MILLS • HOBS

GEAR CUTTERS • UNGROUND GEAR AND SPLINE HOBS • GROUND AND UNGROUND MULTIPLE THREAD MILLING CUTTERS

COUNTER BORES • REAMERS • STANDARD END MILLS AND MILLING CUTTERS FROM STOCK • SPECIAL CARBIDE TIPPED TOOLS

HUDSON
D. O. JAMES MANUFACTURING CO.
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IT IS SIGNIFICANT THAT THE VITAL PARTS OF SO MANY WORLD FAMOUS QUALITY PRODUCTS ARE MACHINED WITH LAKE SHORE TOOLS
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SAVAGE ARMS
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WILLYS-OVERLAND MOTORS.
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MILLING CUTTERS • BROACHES • FORM TOOLS • END MILLS • HOBS

Back of every Lake Shore Tool are the facilities and skilled personnel of one of America's most completely equipped plants.

LAKE SHORE TOOL WORKS

Division of Carbide Tool Company

Send us your blue prints for quotations on your high speed tool, special tool, and carbide production tool requirements.

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HYDROPRESS · INC.

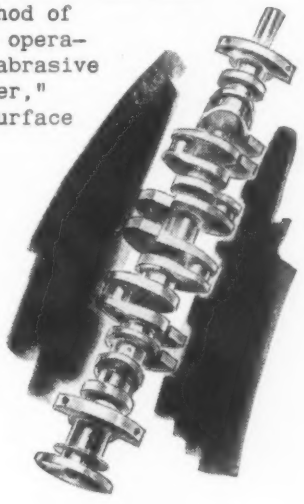
ENGINEERS · CONTRACTORS

HYDRAULIC PRESSES · ROLLING MILLS
STRETCHERS · PUMPS · ACCUMULATORS

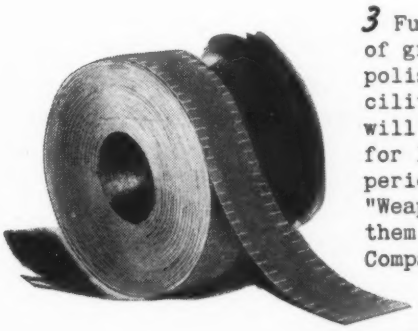
570 LEXINGTON AVENUE · NEW YORK · N. Y.

The darndest machine you ever saw...

1 It has an interesting, complex oscillating motion. It works up and down following crank contours. And it does it all at once! It's the darndest machine you ever saw! Yet it is one of the most efficient and productive machines of its type. Its job is to finish all of the bearing surfaces on a crankshaft at one fell swoop! The older method of performing this same operation is to hold the abrasive cloth in a "nutcracker," finishing only one surface at a time.



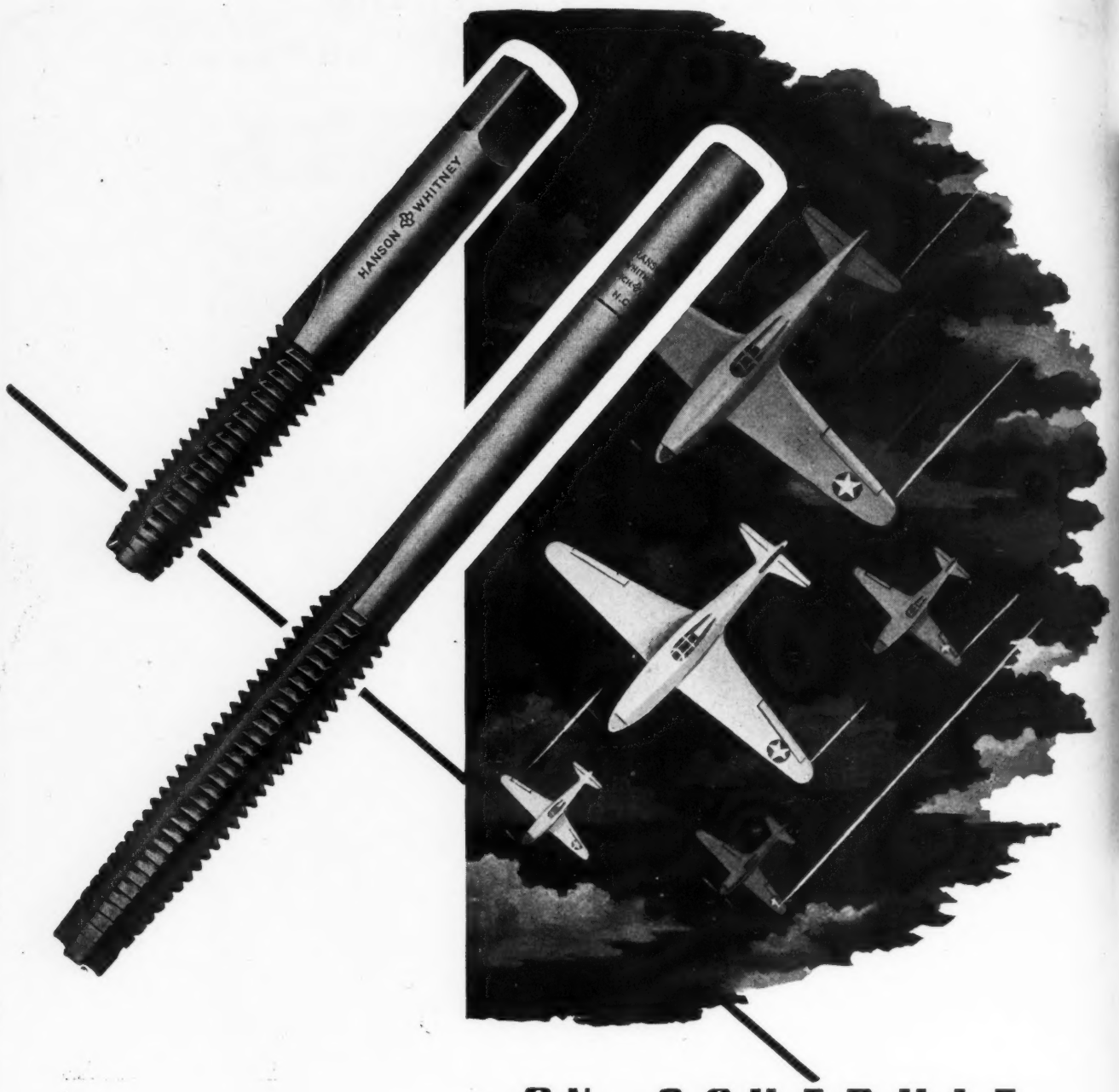
2 With the new machine, strips of successively finer grits of abrasive cloth, having serrated edges to permit the strips to follow the fillets of the bearings, are automatically inched past the revolving crankshaft from a feed roll of the cloth. And on many a job it's Aloxite Brand cloth by Carborundum that gives the ultimate smooth, satin finish.



3 Further improvements in techniques of grinding, finishing, sharpening and polishing, developed through the facilities of The Carborundum Company, will be helping to produce still more for less, now as well as in postwar period. Remember abrasive products are "Weapons for Production." Use them wisely. The Carborundum Company, Niagara Falls, N. Y.

CARBORUNDUM
TRADE MARK
ABRASIVE PRODUCTS

Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company.



ON SCHEDULE

"Impossible" delivery schedule? Specify H-W! H-W Taps deliver long, accurate runs between grinds . . . minimize down time and reduce rejects. And H-W Taps retain precision longer . . . because the "Hanson Process," our exclusive method of finishing after hardening, insures uniform grain structure from tip to shank. If you have a tapping problem, write or wire . . .

ARMY E NAVY

THE HANSON WHITNEY MACHINE CO.

HARTFORD CONNECTICUT U.S.A

NEW HYDRA-CUT FEATURES••

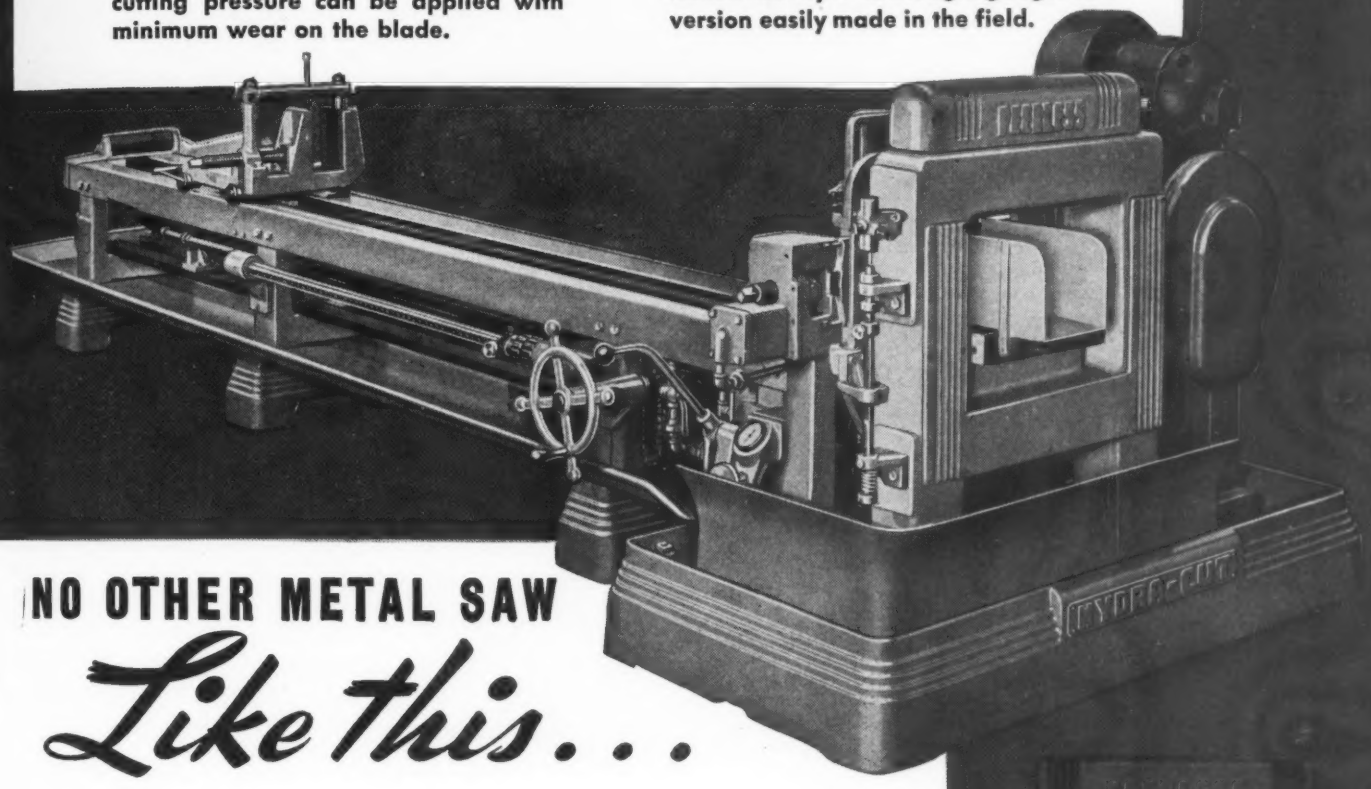
Check them NOW!

✓**SAVINGS**—25% longer sustained cutting accuracy! 33% higher cutting speed! 33% longer blade life!

✓**FEED PRESSURE CONTROL**—Finger-tip Vernier adjustment of feed pressure to the fraction of a pound. Maximum cutting pressure can be applied with minimum wear on the blade.

✓**COOLER CUTTING**—Self-Cleaning Coolant Pump. 75% more coolant capacity.

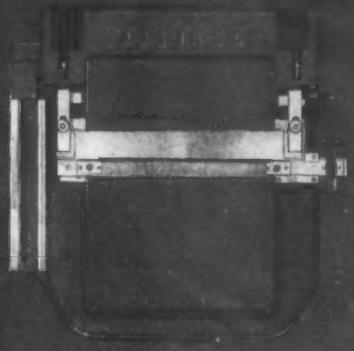
✓**CONVERTIBLE**—The Hydra-Cut is convertible for single or multiple-bar, automatic cutting, by adding a self contained conveyor and length gauge. Conversion easily made in the field.



NO OTHER METAL SAW *Like this...*

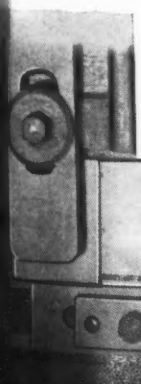
New cutting accuracy and still higher cutting speeds are assured with the Peerless Hydra-Cut! It has the patented Peerless girder-type Four-Sided Saw-Frame which has distinguished Peerless Saws throughout industry. The Backing-Plate Blade-Support fully surrounds the blade and the work, gives added rigidity, prevents bowing, and lengthens blade life. The Saw-Frame is fitted with double-feed cylinders. Saw-Frame and Guide operate on hardened and ground inserts.

Ask for the new Hydra-Cut catalog. It explains these and many other features which speed up metal cutting and lower production costs.



• *Only Peerless Metal Sawing Machines have the Four-Sided Saw-Frame that surrounds the Blade and the Work.*

PEERLESS MACHINE COMPANY, *1600 Junction Ave., Racine, Wis.*
Builders of Fine Tools for Thirty Years



PEERLESS

Metal Cutting Saws

FAST ACCURATE CUTTING DEMANDS PEERLESS BLADE CONTROL

Peerless Machine Co., Dept. M-244, Racine, Wis.
Send the new 12 page catalog, giving specifications, cutting time estimates, and average blade life of the Hydra-Cut.

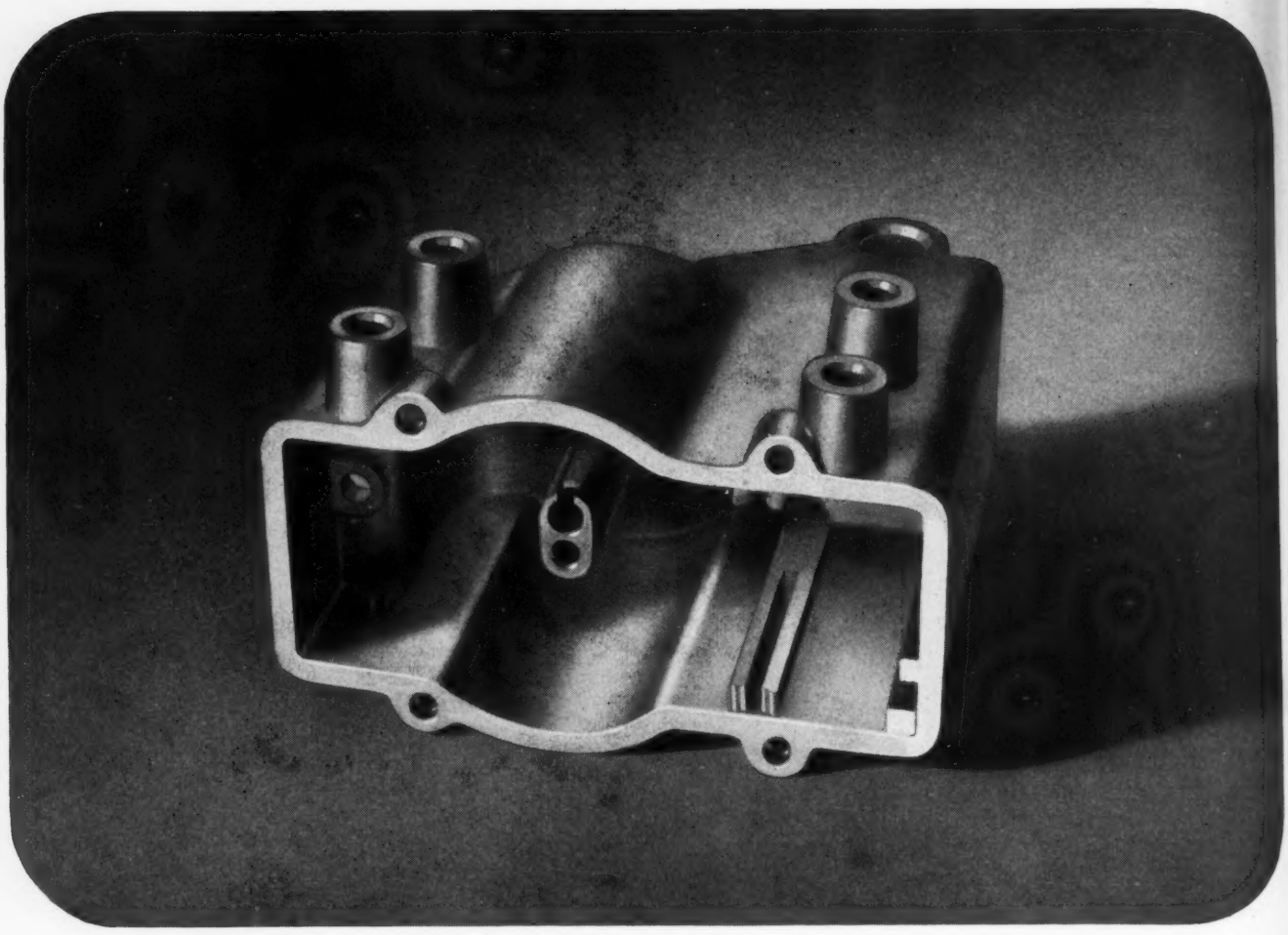
Company_____

Individual_____

Street_____

City_____ State_____

MADISON-KIPP *Die Castings*

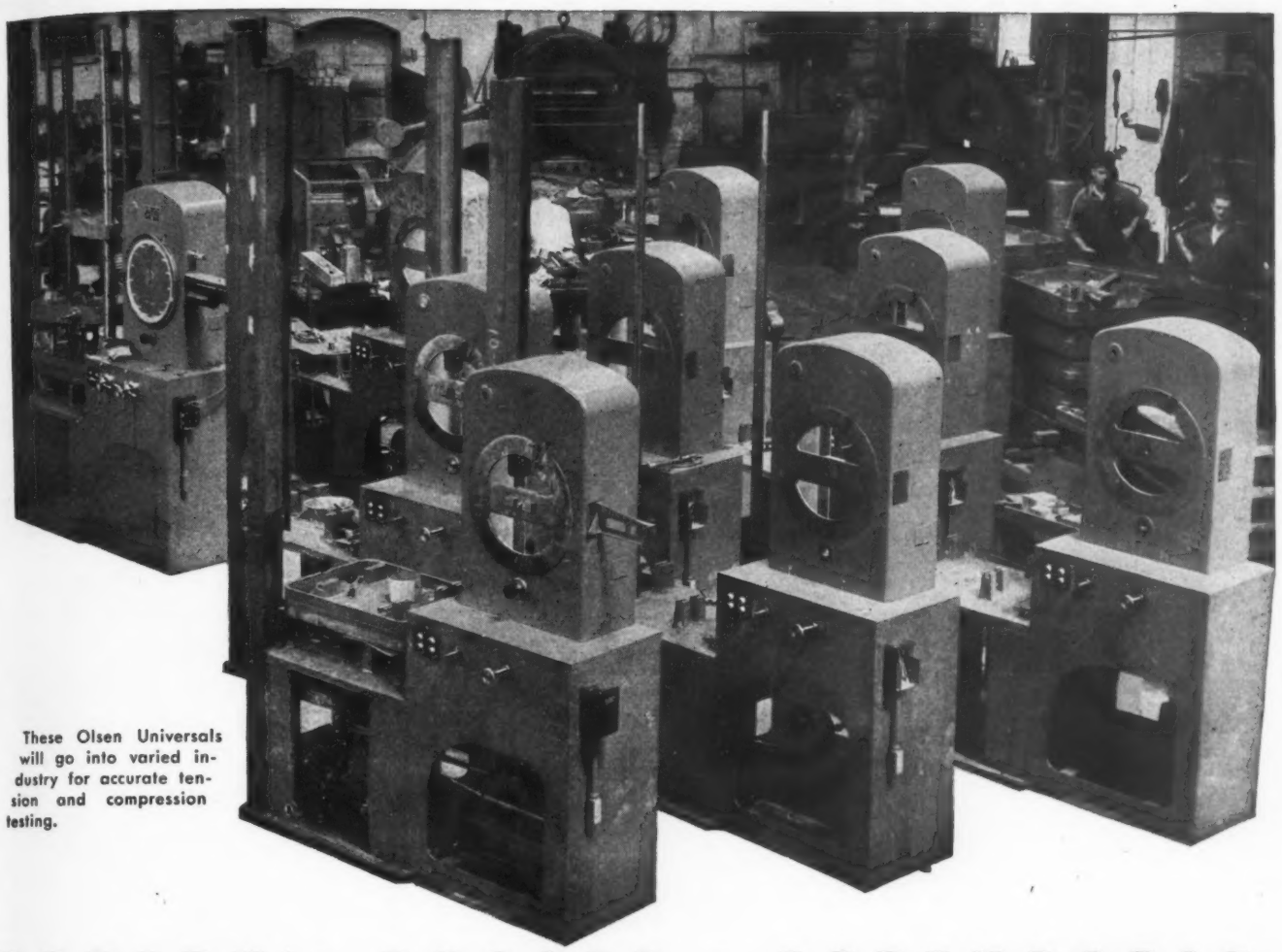


AFFORD ALMOST COMPLETE FREEDOM OF DESIGN

The ingenious Madison-Kipp Die Casting Dies and Fast Trimming Fixtures have afforded hundreds of product designers great freedom of design without cost penalty, and often with an over-all cost saving. The Madison-Kipp Die Casting Department is experienced in handling all die casting alloys of Zinc and Aluminum. Blue prints and samples should be sent to the home office in Madison where all recommendations and estimates are made.

MADISON-KIPP CORPORATION, 203 Waubesa St., Madison 4, Wis., U. S. A.

Sole Agent in England: Wm. Coulthard & Co., Ltd., Carlisle



These Olsen Universals will go into varied industry for accurate tension and compression testing.

MODERN • RUGGED • DEPENDABLE

OLSEN

UNIVERSAL TESTING MACHINES

Tinius Olsen Physical Testing Machines for Metals and Plastics are preferred because hundreds of users recognize the fact that the value of testing depends upon the quality of the testing machine.

The Olsen Universals pictured above were photographed on the "production line"— they vary widely in size and capacity — many are to be equipped with the exclusive Olsen Electronic High Magnification Recorder for stress-strain curves. All are produced with the same Olsen precision which has been a byword in testing machines for the past 65 years.

If you are interested in obtaining detailed information on the complete line of Olsen Universals, write today to

Proving every day that the value of testing depends on the quality of the testing equipment.

TINIUS OLSEN TESTING MACHINE CO.
530 NORTH TWELFTH STREET, PHILADELPHIA 23, PA.

REPRESENTATIVES: PACIFIC SCIENTIFIC COMPANY, Los Angeles, San Francisco, Seattle
MINE and SMELTER SUPPLY COMPANY, Denver, Colorado.

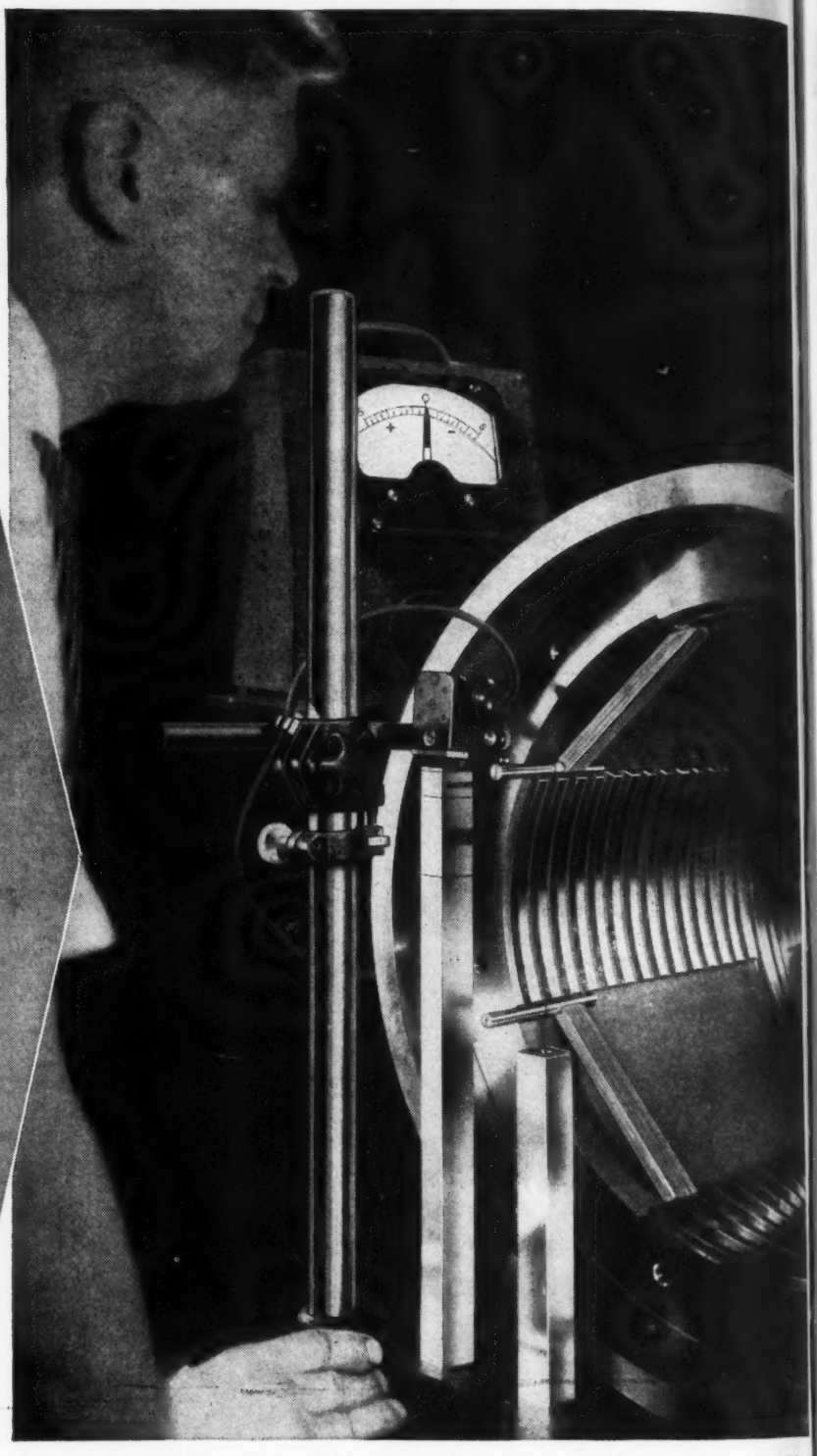
PHYSICAL TESTING EQUIPMENT • BALANCING MACHINES

THROUGH ALL THE RUSH

One Fundamental Remains Unchanged

ACCURACY cannot be rushed . . . not the kind of accuracy that Pratt & Whitney has supplied to industry these past 83 years.

We know full well the desperate pressure and rush of war production . . . we've served faithfully through many of our country's wars. But never in any of these emergencies has the Pratt & Whitney standard of accuracy been sacrificed for speed. Enlarge our facilities . . . yes. Add and train thousands more men . . . yes. But lower our standard of accuracy . . . never. Through peace and war, Pratt & Whitney machine tools, small tools, and gages are made to one rigid standard of accuracy which has never changed.



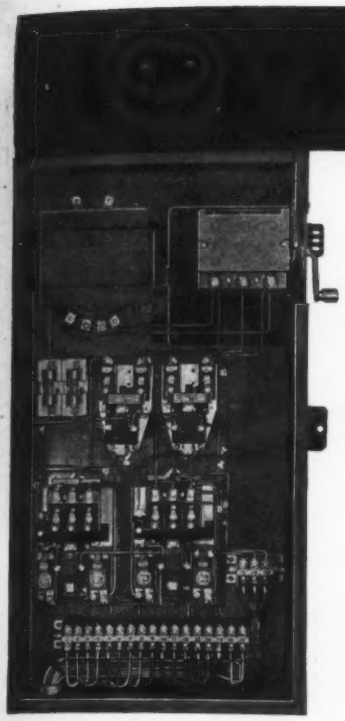
Accuracy — to millionths of an inch — at work on the war production front. A skilled craftsman uses a stack of P&W Hoke Precision Gage Blocks to check a vital point in a breech block gage.

Since World War I — when P&W pioneered and perfected the manufacture of these Hoke Precision Gage Blocks — they have steadfastly remained *the* basic standard of measurement.

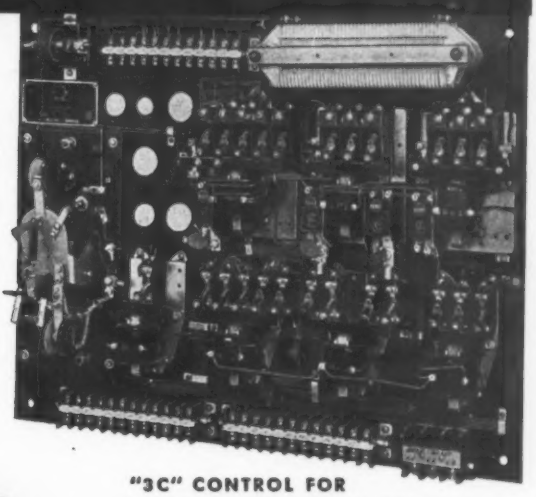
PRATT & WHITNEY

Division Niles-Bement-Pond Company

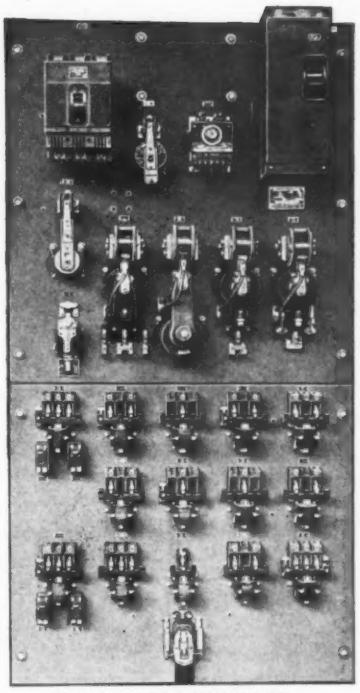
WEST HARTFORD • CONNECTICUT



SPECIAL "3C" MACHINE TOOL CONTROL PANEL



"3C" CONTROL FOR HORIZONTAL BORING MILL



SPECIAL CRANKSHAFT MACHINE CONTROL

"3C" Control Apparatus, long standard in heavy duty applications, is proving its merit in thousands of wartime machine tool operations.

Each "3C" contactor, relay, push button or other control device is designed to stand up under frequent operation in heavy duty service.

"Will it deliver production line service?" is the first question asked of our apparatus, for continuous START-STOP operations demand exceptional service and durability.

This built-in durability is demonstrating its fitness in 24 hour per day service, where electrical control, as well as motors and machines are run by several different operators.

"3C" Accessory Devices, such as Cam Limit Switches, Hatchway Limit Switches, Foot Switches, Push Buttons in countless combinations, are also helping production efforts with low maintenance operation.

"3C" Control is readily engineered to your particular needs.

STREAMLINED CABINET WITH LOUVRED TOP FOR HOUSING RESISTORS

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

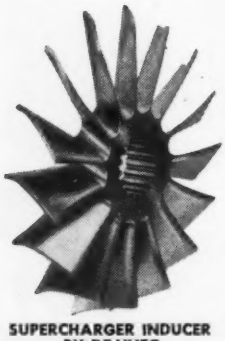
1146 EAST 152ND ST. CLEVELAND, OHIO

"We could not, in honesty, acknowledge our pride on this occasion without paying a special and public tribute to our fellow employees. To a very major degree, this widely coveted and proudly possessed award now flies above the DeVlieg plant because of their loyalty, their devotion to the job at hand and to their uninterrupted effort. Although this honor comes from past achievement, it is proper to say here that another DeVlieg project now nearing completion will make possible another sensational step-up in the performance of still another type aviation engine."

Chas B. DeVlieg. H. R. DeVlieg E. P. DeVlieg

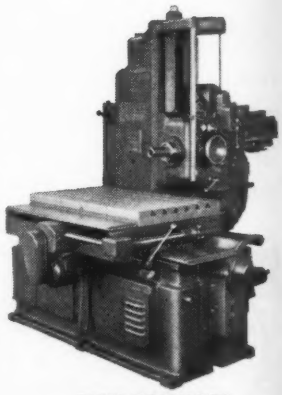
DEVLIEG

FERNDALE - - - MICHIGAN



SUPERCHARGER INDUCER BY DE VLIEG

The acceptance of the DeVlieg art by industrial America was originally based on the superiority of DeVlieg milling methods, and the "E" award was conferred for a revolutionary application of these basic methods. This new application involved the development of the process and the machines by which is being produced the inducer portion of *ALL* the superchargers of the Allison and Rolls Royce aviation engines. As a result of this one application of the DeVlieg art, both of these famous engines demonstrate importantly increased performance. At the same time, the inducers themselves are being produced at *FIVE PER CENT* of their original cost with a reduction in required machine tool investment of *NINETY PER CENT!* Today what formerly was a complex manufacturing operation calling for the highest type of veteran craftsmanship is now capable of being performed by women.



JIGMIL BY DE VLIEG

HERE'S WHY

Westinghouse Gearmotors

MEET YOUR POSTWAR DESIGN PROBLEMS TODAY

Smooth, functional design of the new Westinghouse Gearmotor blends with modern machinery in any application. Gear case is split horizontally at shaft centers for easy inspection and maintenance.

Gears and bearings are thoroughly lubricated by a positive splashing system. New gearmotor case design allows oil to circulate freely at all times. Only attention required is to change oil twice a year.

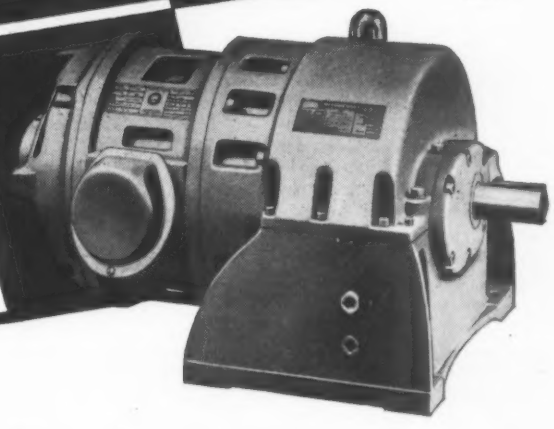
Any NEMA frame standard type Westinghouse motor is interchangeable on the standard gear case. If postwar conversion requires moving gearmotor to new location, type or enclosure of motor can be easily changed to meet new conditions.

"Tough-hard" teeth on surface for long wear—with tapering hardness through the metal, leaving the core tough and strong. Outside surfaces are made extremely hard to resist abrasion—inside cores are made extremely tough to withstand impact stresses.

The efficiency of the new Westinghouse Gearmotor is high—only 2% loss is involved per gear set. Single reduction units offer 98% efficiency, double reduction units 96%.

The new Westinghouse Gearmotors meet A.G.M.A. recommended application practice which makes it easy to order matched gearmotors to any job—eliminates confusion in drawing up specifications.

J-07215



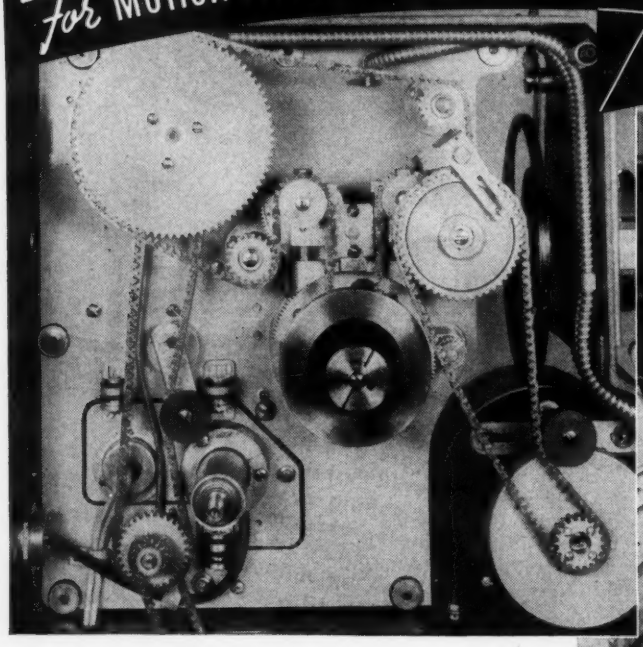
No separate handling, mounting and aligning of separate parts—just ONE unit which can be installed quickly, conveniently and economically.

For gearmotor application information, write for booklet B-3218. Address Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

For MOTION PICTURE PROJECTORS and 30 ton MACK TRUCKS



MORSE makes them both MINUTE and MIGHTY

Movies would flicker, the strong, silent movie hero would threaten the villain with his hands flickering nervously, instead of with calm assurance—all performers would jerkily hop about—if film was passed through projectors at an uneven rate of speed, if slipping drives were used to turn the spools of film projectors.

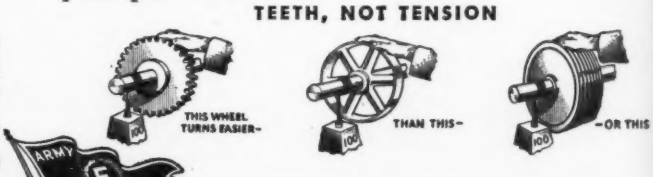
With minute Morse 3/16" pitch chain on the job, however, film spools are turned smoothly and silently, at a constant rate of speed—because Morse Chains *cannot slip*. Flexible, and as positive as gears, minute Morse Chain is ideal for timing motions, for transmitting fractional HP loads.

And, By Contrast . . .

Morse Chains of greater pitch are used on 30-ton Mack Trucks employed in the mining industry, in steel mills, on Diesel engine transmissions—again because they are positive in action, *cannot slip*, cannot waste power.

More efficient transmitters of power, Morse Chains are available in sizes from 3/16" to 3" pitch—for power loads of fractional to 5,000 HP. Exceptionally long-lived, they save money as well as power, by eliminating the need for frequent adjustment and replacement, by upping machine output. Specialists, with close to half a century's experience in the field of power transmission, Morse makes better chain drives, built on the principle of . . .

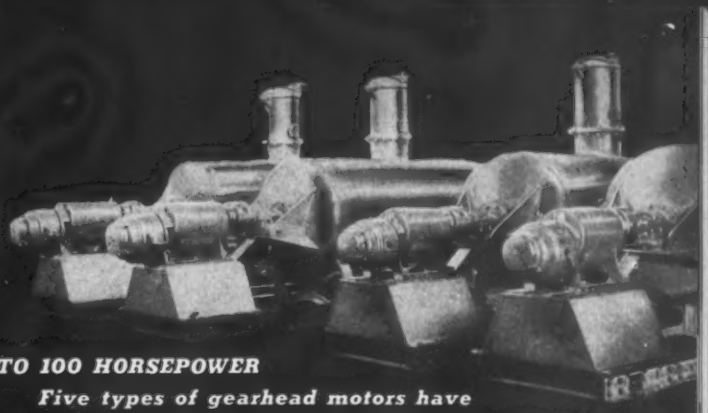
TEETH, NOT TENSION



SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

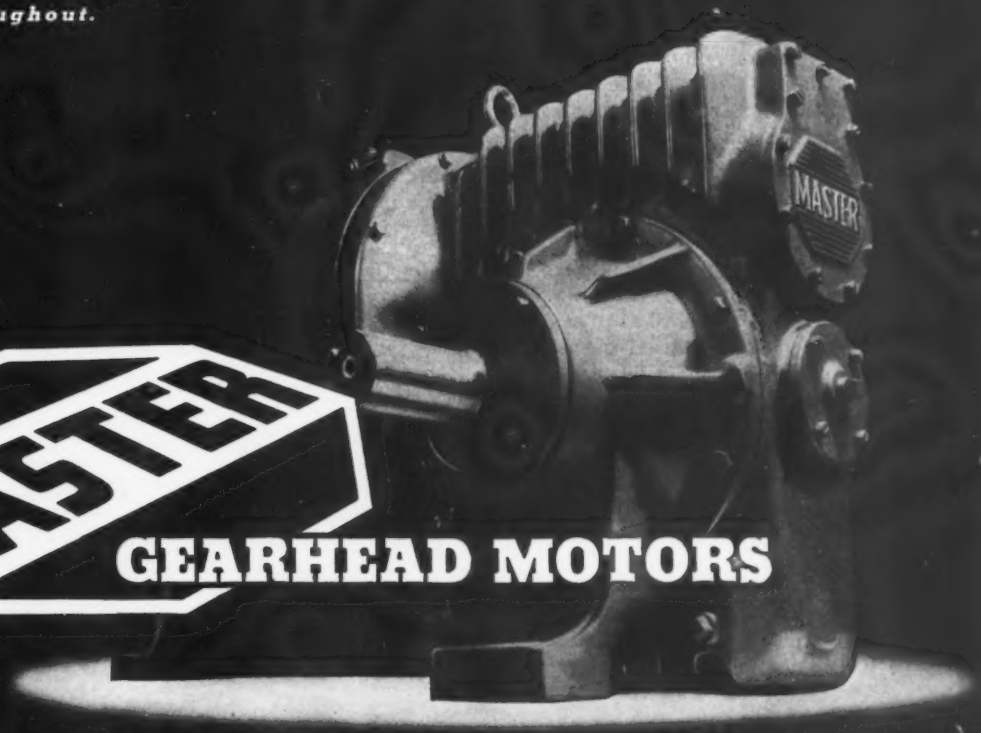
MORSE Roller and Silent CHAINS

MORSE CHAIN COMPANY • ITHACA, N. Y. • DETROIT, MICH. • A BORG-WARNER INDUSTRY



1/10 TO 100 HORSEPOWER
Five types of gearhead motors have reduction ratios ranging up to 432 to 1.

You can secure Master Gearhead Motors for mounting in any position because anti-friction bearings and all-metal lubricant seals are used throughout.



MASTER GEARHEAD MOTORS

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO

Available in a wide range of types including explosion proof, splash proof, fan cooled, multi-speed, uni-brake motors and Speedrangers.

Save material and save space with simple, compact, integrally built Master gearhead motors.

BUY UNITED STATES WAR BONDS AND STAMPS

Soybeans will certainly be one of the country's important crops in the future. A single acre of land devoted to them will produce about seven times as much protein as it would if planted to corn for the feeding of hogs.

The war has checked the spread of quick-freezing locker plants which were spreading across the country from the farming states at the rate of about fifty new plants each month. A million patrons are already withdrawing two million pounds of food from their lockers daily. Home-sized quick-freezing units will probably be combined with mechanical refrigerators in after-the-war models.

The fluorescent tube may have many uses besides those already familiar. Inks that show under ultra-violet light are already in use to mark laundry, and are being tried out in hospitals for the identification of babies. Fluorescent materials help in the detection of theft and sabotage, and in the detection of altered documents. Fluorescent lighting distinguishes between butter and margarine, determines the freshness of eggs and nuts, or the adulteration of coffee, lard and olive oil. Experts can even tell, with its help, from what flowers a sample of honey has been made.

Powdered glass is being pressed into shapes and fused by heat in a manner similar to the technique used for powdered metals.

A machine is reported in which a photo-electric cell scans a drawing and operates a machine that produces the part shown in the drawing.

Cotton, laminated with thermo-setting plastics, is being tried as a substitute for sole leather . . . semi-flexible, water repellent, and similar in appearance to leather, but longer wearing.

New "rare-element" glass that contains no sand makes optical glass for camera lenses with twice the speed of any former lens.

A new method of cutting metal uses slightly worn band-saw blades run at approximately ten thousand feet per minute. The high speed of the saw actually melts the metal in its path.

Baking dishes can now be made of special paper that resists heat to 350 degrees.

The photo-electric cell (or electric eye) was first introduced to the public as an automatic door-opener. Now it sorts fruit, smoke and fire, levels elevators, records automobile speeds, counts pills, matches colors, sorts merchandise, turns on lights, measures machined parts, detects flaws in metal and is the heart of television. Its use has only begun.

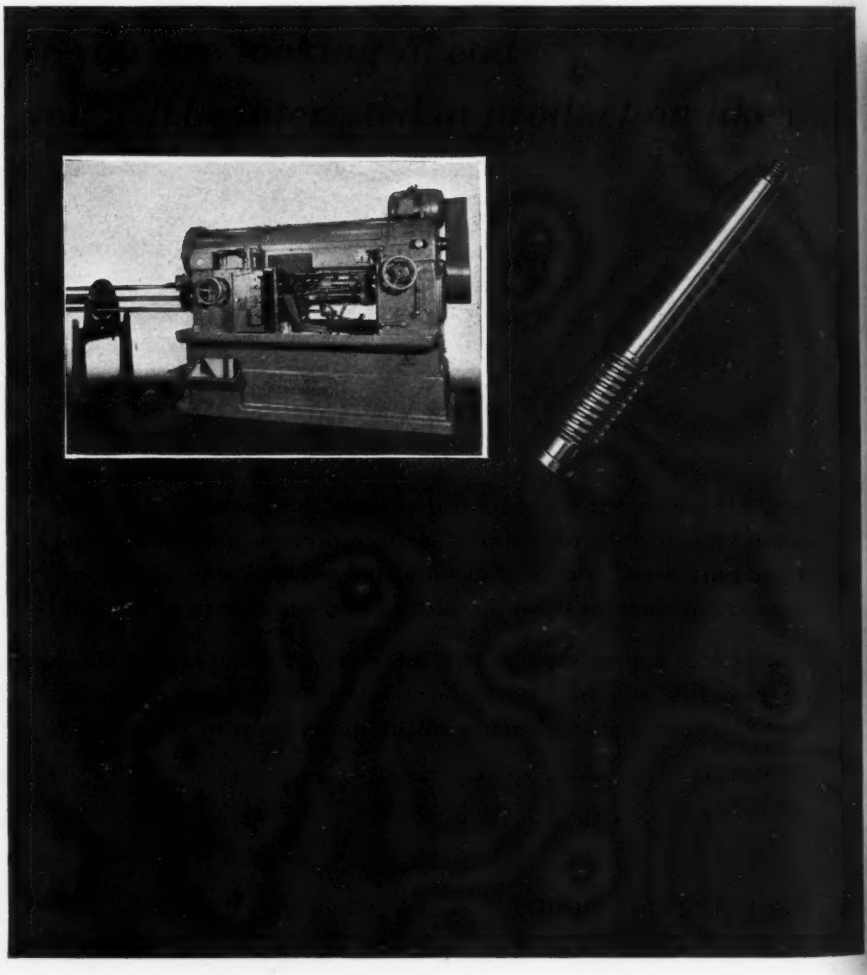
Backyard gardeners will be pleased to know that experiments are being made with high-frequency currents to kill insect pests in the ground.

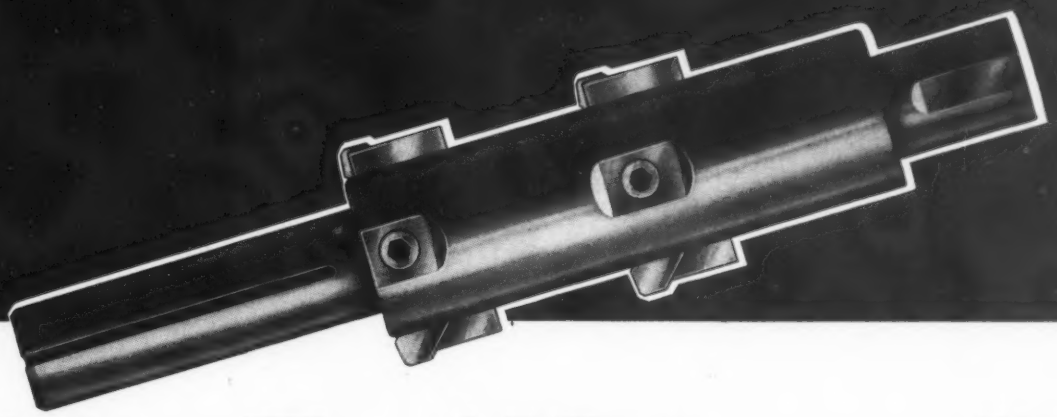
An immediate post-war demand is expected for two million one-hundred thousand automobiles, one-million five-hundred thousand mechanical refrigerators, one-million two-hundred thousand washing machines, one-million two-hundred thousand radios, nine-hundred thousand electric irons, and six-hundred thousand electric sewing machines.

The Basic Magnesium, Incorporated, plant near Boulder Dam, largest single electrical installation in the country, uses eighteen million dollars worth of silver in place of copper to carry its current.

A patent has been issued for a method of transcribing eight hours of continuous reading by variably magnetizing a spool of fine wire the size of an ordinary spool of cotton. With this wire in a radio-like machine, a housewife could attend to her domestic chores and listen to the reading of an entire book at the same time.

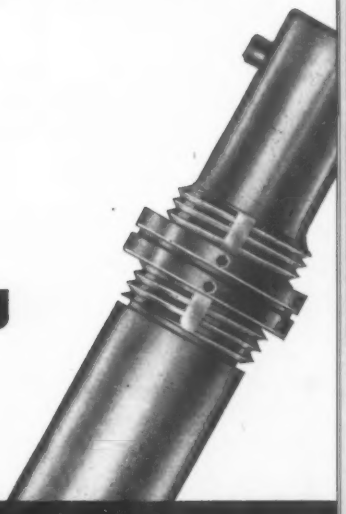
A new camera takes three million pictures in a single second.





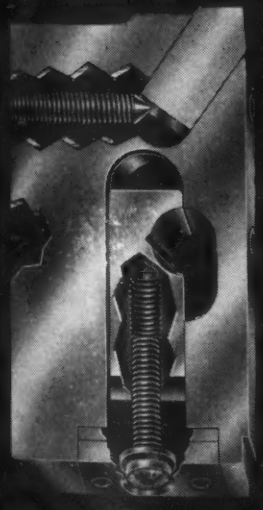
Tool for Final Victory with DAVIS

BLOCK TYPE TOOLS for Boring and Finish Reaming



Where precision work is an absolute necessity, DAVIS Boring Tools are the tried-and-proved answer. In war plants all over the United States, they have set amazing new standards for accuracy—speed—economy. If you have any kind of a boring problem, write us today.

DAVIS BORING TOOLS



DAVIS BORING TOOL DIV. LARKIN PACKER CO., INC., ST. LOUIS 14, U.S.A.

THE OLD WAY — Just 40 years ago, the Wright brothers made their first flight. How crude and flimsy was this hand-made plane compared with the aircraft that pour from American plants today.
NEW SPEED FROM NEW ACCURACY!
THE NEW WAY — In 1944, airplane production lines testify to new production speeds, made possible partly by the dependable new accuracies of precision instruments and production tools.

WEAR-TESTED MATERIALS STEP UP TODAY'S PRODUCTION

American war industries quickly found they could obtain new speed from the consistent accuracy of Woodworth precision gages, ground thread taps, form tools and other perishable production tools.

Wear-tested metals give Woodworth accuracy its extra-long life. Every piece of metal used in Woodworth gages is tested for wear by the severest modern methods.

Old in experience and resourcefulness, Woodworth has charted new ways to speed war production and to cut inspection costs.

After the war, we shall continue to build to that same accuracy, passing on to Woodworth customers all the benefits of Woodworth production methods and their resultant efficiency, which the new peacetime economy will demand.

Our Engineering and Development Departments are available for consultation on special operating and production problems involving gaging and production tools.

ACCURACY YOU CAN TRUST

WOODWORTH

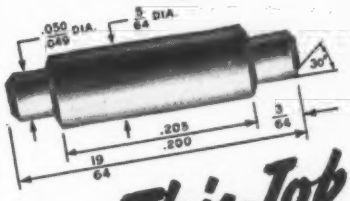
N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD · DETROIT 20, MICHIGAN

PRECISION GAGES · GROUND THREAD TAPS · FORM TOOLS · PRECISION MACHINED PARTS · HEAT TREATING · PLATING

On a GORTON 16-A

50,000

Small Parts like this



How This Job Was Done

TOOLING: 4 standard single-point cutters. 4 flat cams.

SEQUENCE OF OPERATIONS:

1—Turn 30° taper 1/64″ long and turn 2° to 3° taper 1/32″ long to diameter of .0495″ (±.0005″).

2—Advance headstock .205″ and plunge cut for 3/64″ diameter of .0495″ (±.0005″).

3—Turn taper 2° to 3° 1/32″ long and turn 30° taper 1/64″ long.

4—Cut off finished part.

MATERIAL: 5/64″ dia. S.A.E. No. 1060 steel.

PRODUCTION: 10 pieces per minute.

These other typical parts shown actual size

GREATER ACCURACY . . . IMPROVED FINISH

Reduced Grinding Down-Time
Faster, Low Cost Setups

This manufacturer selected the Gorton 16-A Precision Automatic Screw Machine to obtain greater accuracy and improved finish in machining these cam follower pinions—each completed in *one* operation in 6 seconds!

Simple, single-point tools—easy to grind—brought savings in down time required for grinding the forming tool used in previous methods. Rigid construction of the Gorton 16-A—the heaviest Swiss-Type Screw Machine built—enabled precision performance 21 hours daily on production runs of 50,000 parts. Gorton accuracy and Gorton finish eliminated subsequent operations.

Wide Range of Work

The Gorton 16-A produces an almost endless variety of short or long, slender parts — diameters .005″ to 7/16″, lengths 1/32″ to 2¾″—complete in one operation.

It does step turning, generates curves, tapers, back recesses, knurls, chamfers, etc. It centers, drills, slots, threads or taps.

Tool slides are easily accessible. Micrometer adjustments for all tools insure accurate, quick setups at low cost. Centralized fingertip controls provide infinitely variable spindle speeds (1100 to 10,000 R.P.M.) and infinitely variable cam feeds (20 to 720 pieces per hour; 20 to 1440 optional). No speed or feed gears to change.

GORTON Complete Cam and Tool Service

For Any Make Swiss-Type Screw Machine — Gorton or Others

Gorton exclusively offers a complete cam and tool service. Highly skilled engineers are available to take care of all your needs. This service consists of a detailed cam and tool layout, listing all operations of the machining cycle together with necessary cams, tools, collets and bushings. This service is available at the Gorton factory at Racine, Wis., for the Midwest and Pacific areas; and from Russell, Holbrook, and Henderson (our Eastern Distributors) of New York City for quick service in the East.

GET THE FACTS NOW

Mail Today for FREE Bulletin

GEORGE GORTON MACHINE CO.
1316 Racine St., Racine, Wis.

Send me, without obligation, FREE bulletin with complete information covering the Gorton 16-A Precision Automatic Screw Machine.

Name..... *Title*.....

Company.....

Address.....

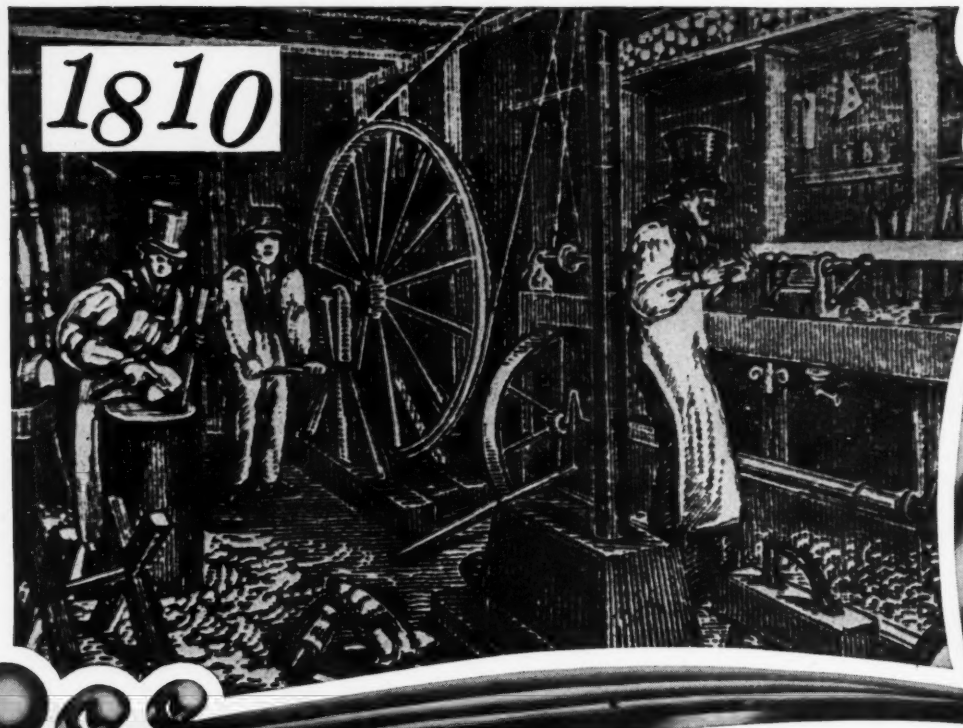
City..... *State*.....

GEORGE GORTON MACHINE CO.

1316 RACINE STREET, RACINE, WISCONSIN, U. S. A.

SPECIALISTS FOR 50 YEARS IN TRACER-CONTROLLED MACHINES—ENGRAVING, DIE MAKING, VERTICAL MILLING MACHINES

Just imagine production then



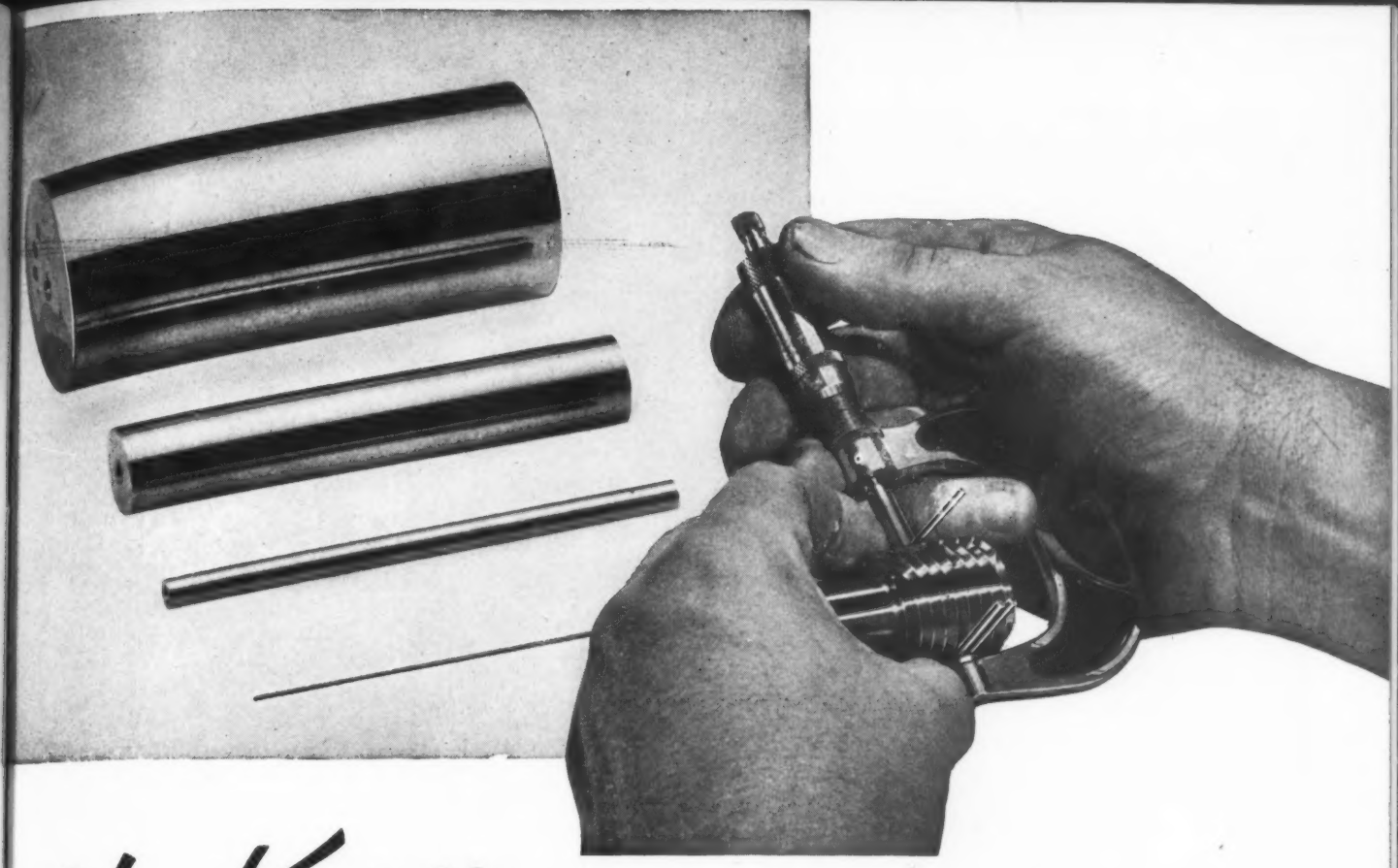
Bettmann Archive

. . . And Now!

ABOVE is an interior view of an American Machine Shop in the earlier part of the 19th century. Eli Whitney's Rifle Shop must be pictured as being equipped with similar machinery and tools. Note the motive power and work being done by hand. Compared by the standards of today, there just was no such thing as production. Perhaps the greatest single improvement over the old methods was the advancement in the use of air and hydraulics . . . the application of air or hydraulic pressure for the operation of chucks, work holding and ejecting devices, assemblying presses and many other labor saving devices. Let "LOGAN" Engineers make recommendations on modernizing your plant with the application of "LOGAN" *Air* and *Hydraulic Equipment.*

"LOGAN"

LOGANSPORT MACHINE, INCORPORATED
910 PAYSON ROAD LOGANSPORT, INDIANA
Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories



Van Keuren

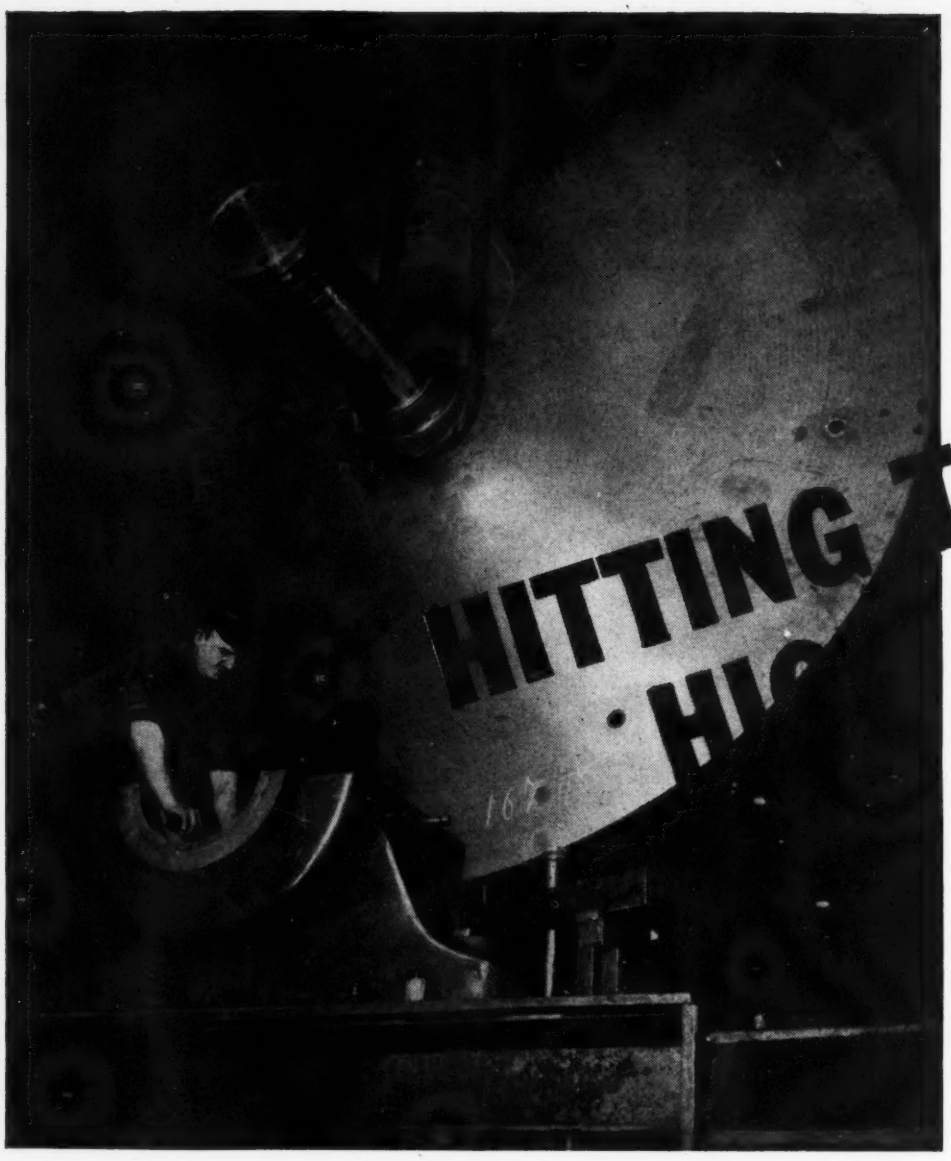
THREAD MEASURING WIRES

A *Standard* FOR ACCURACY IN LEADING WAR PRODUCTION PLANTS

The wire system of thread and gear measurement is easy to use and gives exceptionally accurate results. Our Manual of precision measuring tools gives complete tables and simplified formulas for measuring all standard threads, splines and spur gears. Send for this valuable handbook!

Leading arsenals and war production plants know the importance of accuracy in thread and gear measuring. That is why so many of these plants are using Van Keuren Measuring Wires as standard equipment for measuring thread gages, taps, worms, splines and spur gears. Made in any size from 1.5708" down to .002" in diameter, they are guaranteed to be within .00002" for roundness and straightness and within plus or minus .000025" for size. Special sizes can be made to your specifications as to size and tolerances. Easy to use, Van Keuren Wires bring ultimate accuracy to your operations. Write for full details.

25th Year



HITTING THE HIGH SPOTS

WHEN this 14-foot 38-ton flywheel starts turning up 500 rpm's, the first integrated steel mill on the Pacific Coast will be in operation . . . an interesting wartime development.

An equally outstanding war development is the greatly increased cutting-tool life which war plants everywhere are getting, by using *Texaco Cutting Coolants.*

For example, in producing bomb fin liners, a certain forming tool required sharpening every 8 to 10 hours. Changing to Texaco, the tool now averages 50 hours between grinds.

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed at the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 distributing points in the 48 States.

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

TEXACO

TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT – CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

36 HOLES in Propeller Blade Bushing *held to* ACCURACY *of* ±.0005" *with* HIGH FINISH

All dimensions in boring the 36 high-precision holes in these Bronze Propeller Blade Bushings held to ±.0005".

STOKERUNIT SIMPLEX PRECISION BORING MACHINE

Precision Bores Each Hole in 16 Seconds

A widely known manufacturer of airplane propeller parts is regularly using a battery of Stokerunit Simplex Precision Boring Machines to insure superior finish and precision accuracy in critical boring operations.

In the production of these alloy bronze propeller blade bushings, for example, an extremely fine finish with close tolerances is required in finish boring the 36 holes in the flange. All dimensions—roundness of hole, dimensions between holes and distance from center of bushing—are uniformly held to ±.0005".

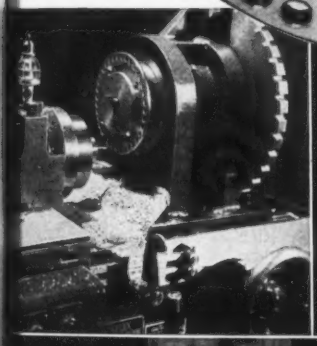
PRECISION ACCURACY AND FINE FINISH MAINTAINED IN PRODUCTION

In this setup, the Stokerunit Simplex Precision Boring Machine bores one hole at a time every 16 seconds in alloy bronze bushings — hardness 90-100 Rockwell. Hole is .3125" in dia. ±.0005" by 1/4" deep. Work slide is equipped with constant reciprocating feed, and indexing is done by hand when work is clear of tool. Feed is 4 7/8" per minute; spindle speed 1750 r.p.m. Every rigid requirement of accuracy and finish is consistently maintained.

VERSATILITY — Stokerunit Simplex Precision Boring Machines can be adapted to a multiplicity of precision boring operations — for either short-run or production work. They can be furnished with single or multiple spindles, depending upon your requirements. Over 25 models are available in both mechanical and hydraulic feeds and cover practically the entire range of precision boring applications.

Profit with precision accuracy, finer finish and increased production in your precision boring operations. Consult our engineers for a study of your parts and production problems.

For specific recommendations, send blueprints of parts with production requirements. No obligation.



(Left) One hole at a time is precision bored every 16 seconds.

(Right) The Simplex maintains precision accuracy and fine finish in production.

(Below) Partial view of battery of Stokerunit Simplex Precision Boring Machines in plant producing airplane propeller parts.

BULLETINS with Complete Data!

Write today for these two booklets covering our entire line of Simplex Precision Boring Machines. Full details and specifications of each type are included.

STOKERUNIT CORPORATION

DESIGNERS AND BUILDERS OF PRECISION BORING MACHINES AND MILLING MACHINES

4526 WEST MITCHELL STREET · MILWAUKEE, WISCONSIN

THE SIGN
OF THE DODGE
TRANSMISSIONEER

WHAT IS TRANSMISSIONEERING?

Transmissioneering is a Dodge engineering technique starting with a study of practical production engineering requirements and resulting in "The Right Drive for Every Job." It is the connecting link between power source and production machine.

Transmissioneering involves the component parts of power drives — bearings — pulleys — sheaves, clutches, etc., each transmissioneered to meet definite service conditions and the assembling of these parts to provide effective drive units.

Dodge transmissioneers in industrial centers provide on the job tranmissioneering and a wide selection of Dodge transmissioneered products available from stock. Call your local Dodge transmissioneer — he will show you how to put *all* your power in the job.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana, U. S. A.

BUY MORE WAR BONDS

The Sign
of the Dodge
Transmissioneer
"Transmissioneering starts with the study of Practical Production Engineering requirements and stops with the Right Drive for Every Job."

DODGE

Copyright 1944
Dodge Manufacturing Corporation

• • • THE RIGHT DRIVE FOR EVERY JOB

WHAT TOLERANCE?

WHAT PRESSURE ANGLE?

WHAT HARDNESS?

WHAT ALLOY?

ILLINITE
PRECISION
METAL CUTTING TOOLS

Ground Hobs

Milling Cutters

Ground Form Tools

Shaper Cutters

Broaches

Special Tools . . . Gear Measuring Machines . . .
Gear Measuring Blocks . . . Die Filing Machines

Fundamentally, it is engineering ability which sets any manufacturing organization apart from its contemporaries . . . . The experience of "Illinois Tool" engineers in solving gear design and production problems is at your service.

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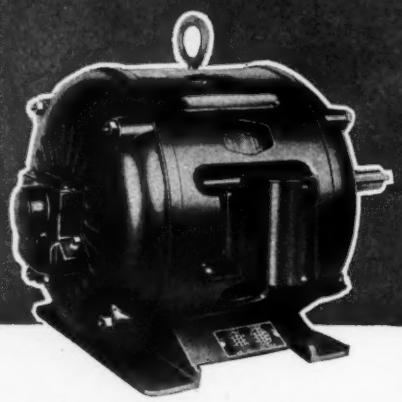
MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

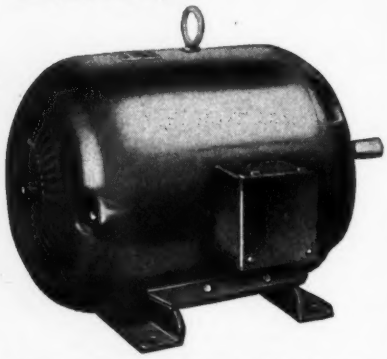
IN TIME OF WAR AND IN TIME OF PEACE...

Wagner MOTORS

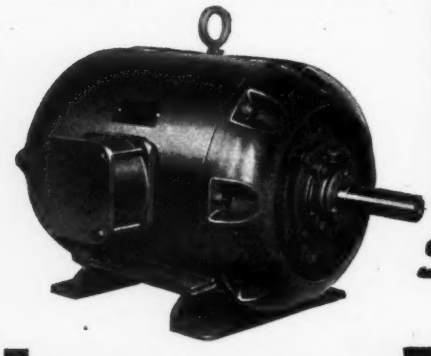
reflect sound engineering and modern manufacturing methods



Wagner type RP Squirrel-Cage Motors are used on machine tools and other electrically-driven equipment that operate in clean, dry locations. 1/6 to 400-hp, 25 to 60 cycle, 2-or 3-phase.



Wagner type CP Totally-Enclosed Fan-Cooled Motors are used on machine tools and other motor-driven equipment, where dust, dirt, filings, chips, fumes and other destructive elements are prevalent. 1-1/2 to 125 hp, 25 to 60 cycle, 2- or 3-phase.



Wagner type HP Explosion-Proof Motors are ideal for machines located where inflammable materials and substances are handled or manufactured. 3/4 to 125 hp, 2- or 3-phase, 25 to 60 cycle.

M43-11

THE skill and facilities Wagner has gained in 52 years of manufacturing quality motors are now being used to speed up Victory. Wherever there is war activity you will find Wagner motors doing a job—on ships, tanks, and planes...in army cantonments and navy yards . . . on motor driven machinery and equipment in shipyards, in mines and in all kinds of plants producing war materials.

Wagner motors have proved their ability to produce dependable power under the most severe operating conditions and they can help you, too, in your war effort.

No matter what type of motor you require—regardless of the torque, speed, or current requirements, you can choose a motor from the Wagner line that is correctly engineered for the job. The three motors illustrated represent just a few of the various types of Wagner motors. Each Wagner motor has special electrical and mechanical characteristics that make it the ideal motor for certain applications.

FIELD ENGINEERING SERVICE

Wagner's 29 branches are manned by trained field engineers competent to solve your motor application problems. They will gladly consult with you and do everything possible to assure you the quickest delivery on the motors you need to keep war production on schedule.

Send for These Valuable Bulletins... Bulletins MU-182 and MU-183 illustrate and describe the complete line of Wagner motors—a motor for every purpose. Copies of these bulletins will be sent upon request.

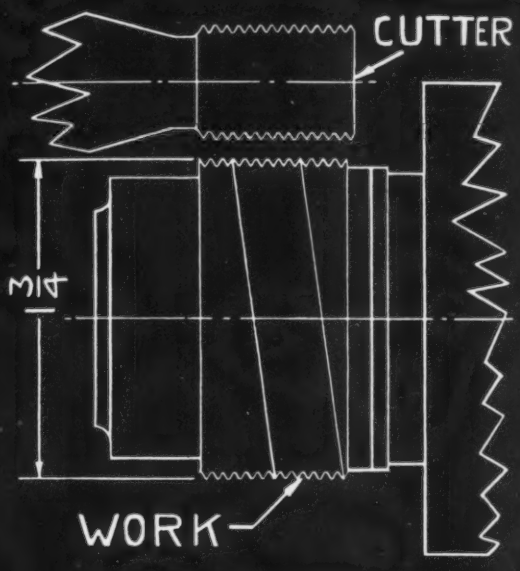
Wagner Electric Corporation

ESTABLISHED 1891

6467 Plymouth Avenue, St. Louis, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS

PLAN-O-MILL



with TWICE *the Speed*— HALF *the Manpower*

We've said it before. We say it again. Obsolete machines are wasteful.

Notice the relatively small, solid, low-cost cutter used to mill this external thread. Plan-O-Mill rapidly and accurately mills this sextuple thread in a single revolution of the milling cutter around the work!

For thread milling, for cylindrical forming—internal or external—Plan-O-Mill delivers outstanding accuracy, superior finish, and most profitable production. One operator handles two or more Plan-O-Mills.

Replace those obsolete machines with Plan-O-Mills! Contact your machinery dealer or write direct.

"FIRSTS" WITH PLAN-O-MILL

- ***First*** **to install General Electric's remarkable new Thy-mo-trol electronic feed control!**
- ***First*** **planetary to mill external threads with standard multiple thread cutter!**
- ***First*** **planetary to coordinate feeds and speeds!**
- ***First*** **to provide absolute control of feed-in!**

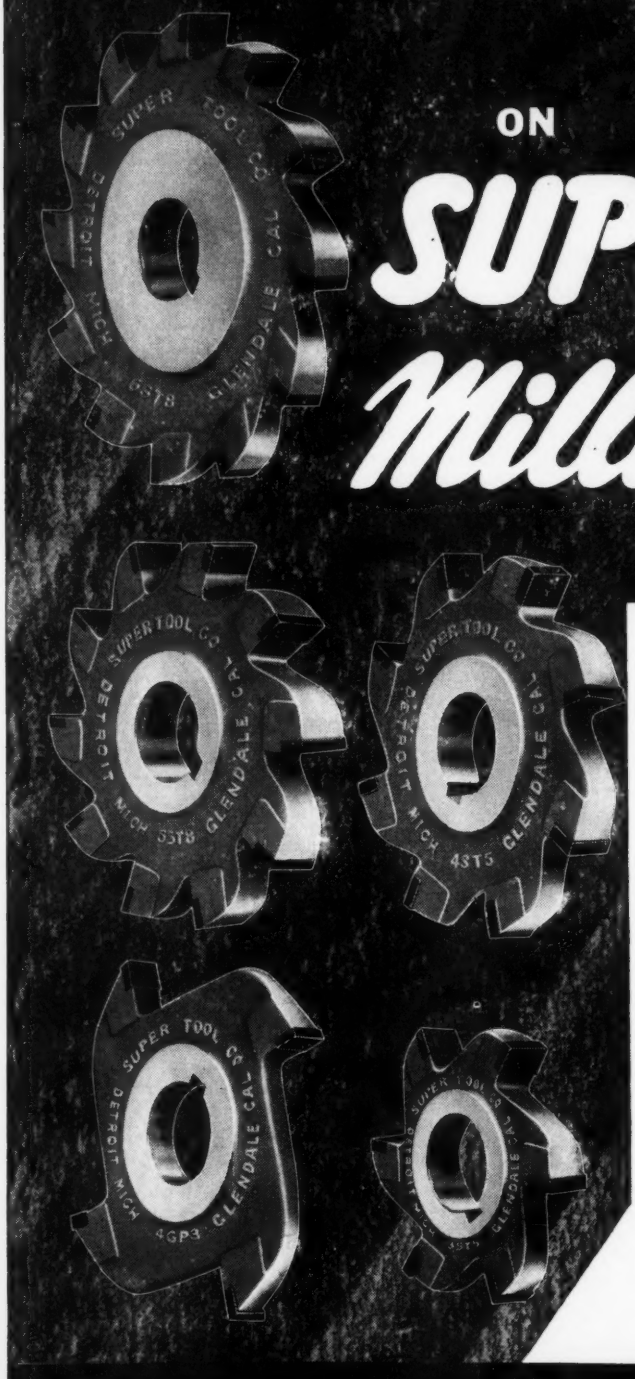
PLAN-O-MILL
CORPORATION

1511 East Eight Mile Road • Hazel Park, Michigan

PRICES DOWN 25%

ON

SUPER CARBOLOY TIPPED *Milling Cutters!*



Here's money-saving news for production men! A 25% price reduction on Super Carboloy Tipped Standard Milling Cutters! Think of it! Now you can get the speed, accuracy and dependability of these high quality cutters at prices that mean *extra* economy on all types of production jobs . . . . long runs, short runs, even general shop tooling.

How is this price reduction possible? You'll find the answer in our plants—engineering research and development, improved manufacturing techniques, increased production. And we are passing these savings along to you.

If you haven't yet tried Super Carboloy Tipped Milling Cutters, now is the time to do it! You'll learn first-hand why production men the country over who are interested in stepping up production and stepping down costs, specify SUPER. Write TODAY for complete details as to descriptions, sizes and new low prices.

All sizes available from stock for immediate shipment

SUPER TOOL COMPANY

Carbide Tipped Tools

21650 Hoover Road, Detroit 13, Michigan ★ 4105 San Fernando Road, Glendale 4, California

FITCHBURG GRINDS ACCURATE TO .000025"

ASK FOR YOUR COPY

CONTINENTAL MACHINES
Incorporated
1301 WASHINGTON AVENUE SOUTH
MINNEAPOLIS

October 8, 1943

The National Machine Tool & Supply Co.
Att: Mr. C. O. Hanson
13 No. 1
Minneapolis, Minnesota

Dear Mr. Hanson:

I believe you will be interested in a job which we performed on the Fitchburg Grinder recently purchased from you.

The job consisted of grinding the O.D. of a piece of hollow tubing 1-1/2" in diameter and approximately 4" long. This part is used as a master squaring gage, and the grinding had to be held to extremely close tolerance of accuracy. Several attempts were made to grind the part by conventional holding methods, but it was found that upon releasing the work from the arbor it would distort beyond the limits to which the part had to be held. We finally devised a method of holding the tubing during the grinding operation, and using the Fitchburg Grinder we were able to grind 100 of these parts to an accuracy of 25 millionths maximum taper over the 4" length, and within 25 millionths of concentricity.

Needless to say, we are very well pleased with our Fitchburg Grinder when we can use it to grind down to millionths in accuracy.

Yours very truly,

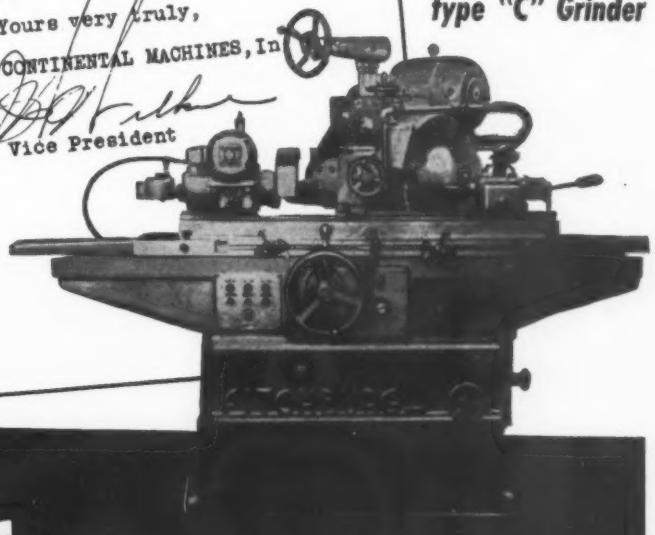
CONTINENTAL MACHINES, Inc.

Vice President

JWWilkie.cm

TWO PARTS FROM ONE PIECE WITH DOALL
LESS THAN .002" VARIATION TOP TO BOTTOM
SPECIAL SHAPES IN RECORD TIME
ALLOY STEEL 1 HR. INSIDE 1½ HRS. OUTSIDE
ONLY 2½ HOURS FOR ENTIRE JOB
75% SAVED ON LARGE INTRICATE DIE AND ONE SHOE

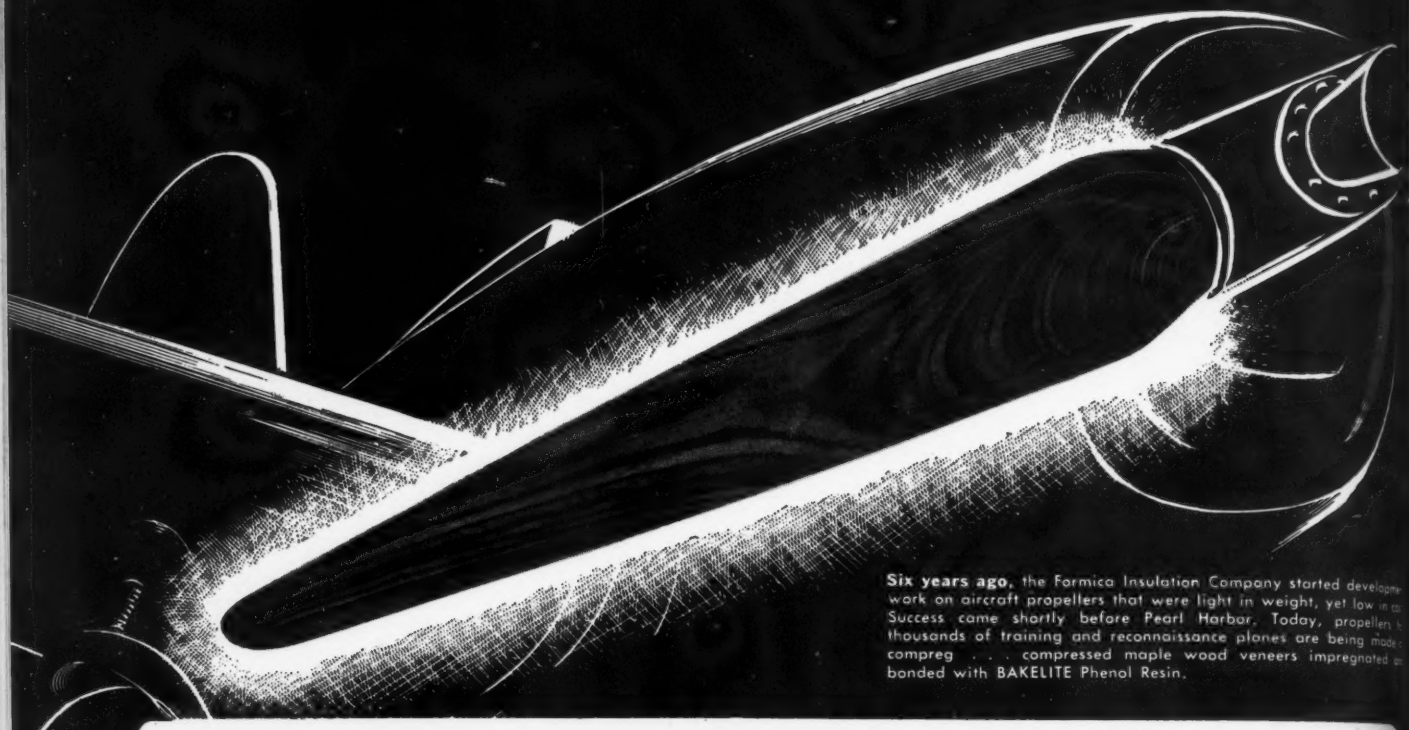
Unsolicited letter received by Fitchburg regarding type "C" Grinder



FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U. S. A.

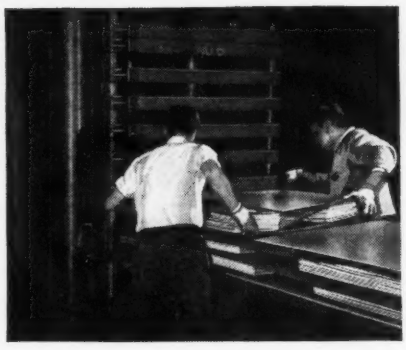
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

How can BAKELITE *Plastics*



Six years ago, the Formica Insulation Company started development work on aircraft propellers that were light in weight, yet low in cost. Success came shortly before Pearl Harbor. Today, propellers for thousands of training and reconnaissance planes are being made of compreg . . . compressed maple wood veneers impregnated and bonded with BAKELITE Phenol Resin.

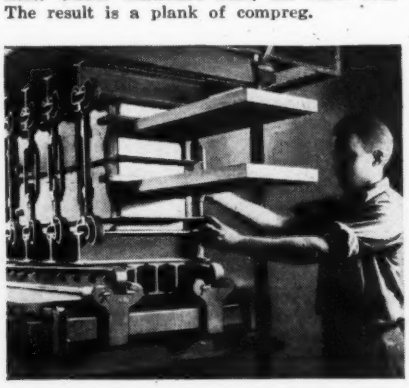
Choice maple veneers are placed in a cage, lowered into a vat of BAKELITE Phenol Resin. Vacuum, then pressure, assures complete saturation into the wood of this thermosetting resin. Later the veneers are removed and stacked to dry.



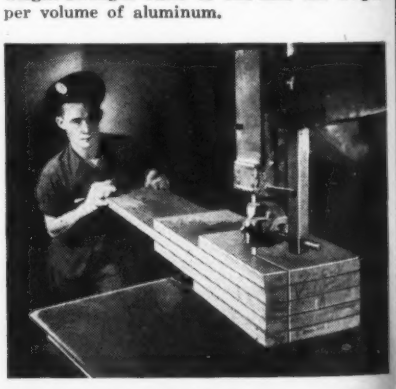
The impregnated veneers are then laid up and placed in a hydraulic hot-press. Here the heat softens the resin, the pressure compresses the wood to one-half its original thickness. Under continued heat, the resin sets. The result is a plank of compreg.

Here a worker is shown planing the densified wood block to assure perfect bonding in later operations. Measured in the grain direction these compreg planks can be said to have a weight-strength ratio of one-half the weight per volume of aluminum.

The planks of compreg are then coated with BAKELITE Phenol Resin and laid up to form the rough shape of the finished propeller blade. The metal plates dividing each unit are electrodes that will carry the high-frequency current used to bond the compreg planks to a single block of densified wood.



In the electrostatic press, high-frequency electrical current is passed through the entire propeller assembly, generating uniform heat throughout its entire depth. This is extremely important since only hot-setting resins can give the necessary bond, and since the tremendous thickness makes it impossible to use the steam platen or oven-heating processes.



After removal from the press, the blocks are rough-cut, then finished to form lightplane propeller blades. Although made of wood, these blades are water-resistant . . . have a tensile strength of 30,000 pounds per square inch, flexural strength of 40,000 pounds, and shear strength of 8,000 pounds.

improve your products?

Can you produce them faster?... Can you improve them structurally, electrically, mechanically?... Can you build them at lower cost? The answer has been "Yes" for hundreds of products whose manufacturers have investigated BAKELITE Plastics.

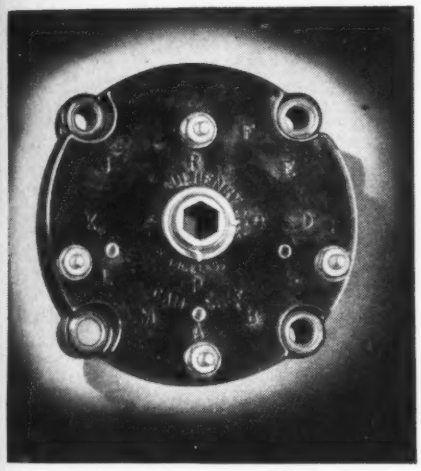
Complex shapes are being molded quicker... resulting in sturdy, finished parts at remarkably low cost. Coatings and finishes have been developed with BAKELITE Resin bases that are easier to apply, and that are far more durable and resistant. Wood has been given new strength and endurance... is now being fabricated in curved plywood sections up to 84 feet in length. Cloth laminated with BAKELITE Laminating Varnishes saves 45 per cent in weight of fighter plane ammunition boxes.

These and other examples illustrated on these pages are typical of the scores of applications and developments that you will keep posted on when you are in touch with Bakelite Plastics Headquarters. Our Engineering Staff and Development Laboratories can help you with essential problems. The literature illustrated below can help you with your present and postwar planning.

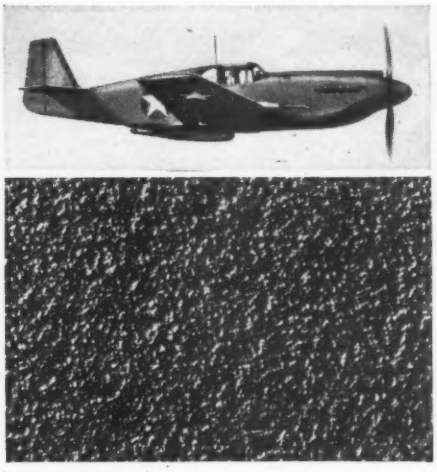
Write for specific technical literature today. Please address Dept. 12.

BAKELITE CORPORATION
Unit of Union Carbide & Carbon Corporation
UCC
30 EAST 42ND STREET, NEW YORK 17, N. Y.

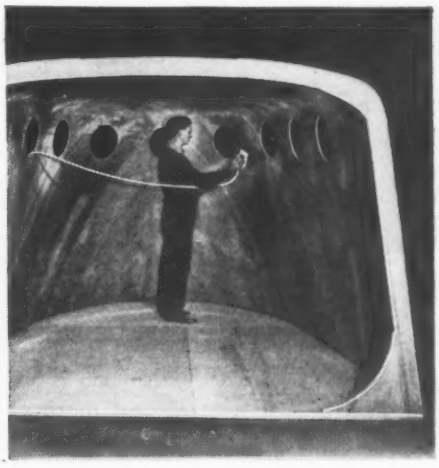
The preselector dial drum that automatically figures the gear ratios and speeds in the use of a No. 5 Warner & Swasey turret lathe was formerly made of metal. It is now molded of a BAKELITE *General Purpose* Phenolic Plastic eliminating several machining operations. The conversion has meant an important savings of metal and a reduction in production costs of approximately 80 percent.



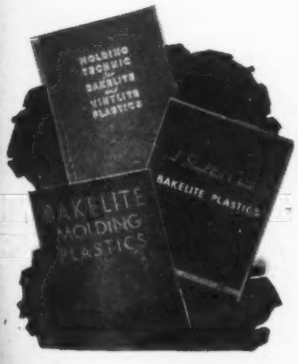
After designing a new type rotary cam selector switch for sequence switching on airplanes, the Paul Henry Company found that simplified production and low cost demanded the use of a molded plastic. But which one? Experimentation pointed to a BAKELITE *Impact-Resistant* Phenolic. Further tests proved this material to have good electrical characteristics, high impact and tensile strengths, excellent heat and moisture resistance. Sales are up, production costs are down 20 percent... because this manufacturer investigated BAKELITE Plastics.



On the steps, catwalks, and cockpit floors of military aircraft, a covering that will withstand wear, yet be skid-proof, is absolutely essential. Rubber is slippery when wet. Other materials wouldn't stand the abuse. The Western States Lacquer Company developed an abrasive coating, particles of hard aggregate suspended in a rubber-like BAKELITE Plastic base. Sprayed or troweled on, this new coating gives a resilient, sandpaper-like surface to the flooring of some of America's leading bombing and fighter planes.



Deck houses for small boats are now being molded of plywood in a single piece. At the Haskelite Manufacturing Company's plant, veneers of wood coated with BAKELITE Resin Glue are laid in diagonal strips over a mold. Then low fluid pressure and controlled heat are applied which forces the plywood assembly to the exact contour of the mold and sets the glue. The finished deck house is 12 feet long, 9½ feet wide, and 8 feet high. It is light, strong, and durable.



USEFUL LITERATURE ON PLASTICS

"A Simplified Guide to Bakelite Plastics" gives a summary of the principal BAKELITE Plastics now available. It describes each type briefly, and illustrates typical applications. **"Bakelite Molding Plastics"** provides further information, and A.S.T.M. data on moldable plastics. **"Molding Technic for Bakelite and Vinylite Plastics"** is a 224-page manual on the art of molding plastics. It contains comprehensive data that the designer, engineer, molder, and user should have on the design and fabrication of hot-set and cold-set molding materials. Price $3.50 postpaid. Additional pamphlets and booklets describing other types of BAKELITE Plastics are also available. Write to Department 12, requesting these valuable guidebooks.

BAKELITE
TRADE MARKS
The word "Bakelite" and the identifying products Symbol are registered trade marks of Bakelite Corporation

PLASTICS HEADQUARTERS

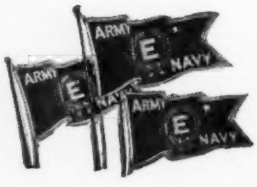
GIVE THEM THE BEST

Give Them Air Tools

The cost of power for any portable tool is small when compared with the operator's wages. Therefore, consider aiding your operators by giving them smaller, lighter and more powerful AIR tools which will enable them to do an easier, quicker and better job.

Flexibility of *AIR* Power . . . More types of work can be done with AIR tools than with any other type of portable tools. Their wide range includes not only rotary applications (such as drilling, reaming, grinding, nut running, etc.), but also such percussive applications as riveting, chipping, ramming, tamping, etc.

Flexibility of Control . . . AIR-powered tools can be started and stopped instantly—this speeds up repetitive operations. Torque and speed can be varied throughout the capacity range—full power can be obtained immediately. This control permits the operator to fit the tool exactly to his work from moment to moment.



Flexibility of Application . . . Flexible control automatically gives the AIR tool wide application. It can be used on a great variety of materials—it will handle numerous types of jobs in any shop.

Choose from the complete line of I-R AIR tools . . . and increase your production.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

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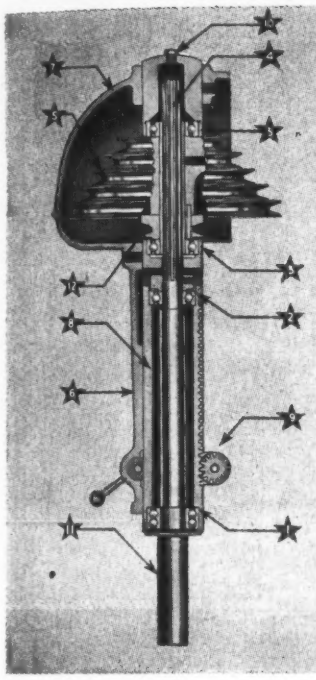
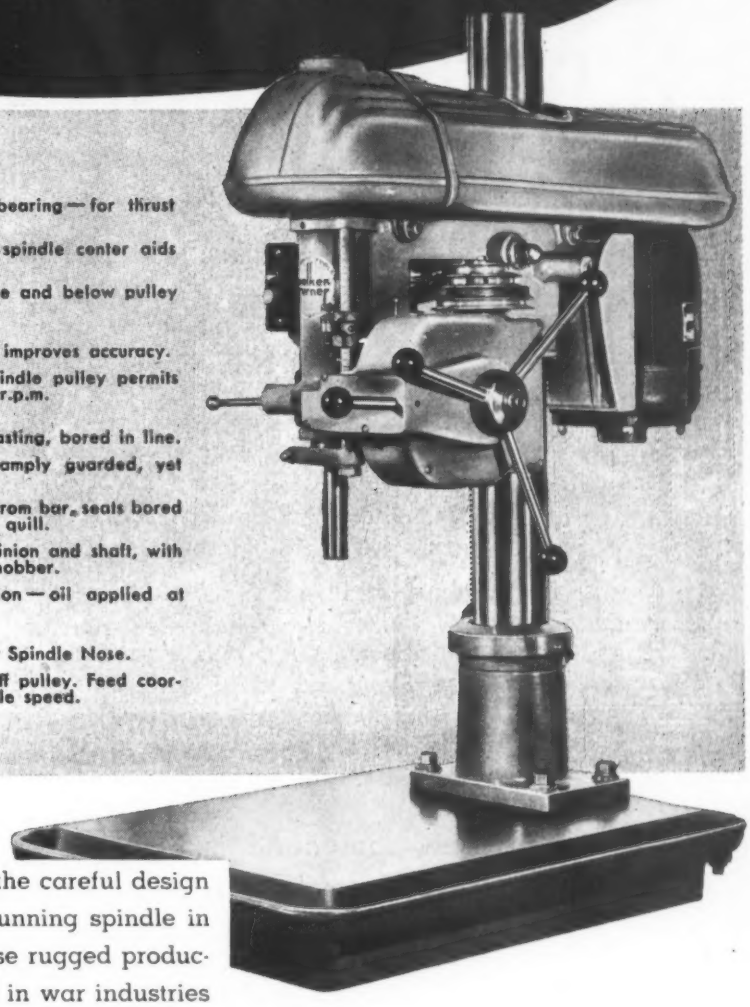
COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • CENTRIFUGAL PUMPS • CONDENSERS • OIL AND GAS ENGINES

Why Industry Prefers THE WALKER-TURNER 20" DRILL PRESS!



1 Double row ball bearing — for thrust and radial load.
2 Ball bearing near spindle center aids rigidity.
3 Ball bearings above and below pulley eliminates whip.
4 Ten spline spindle improves accuracy.
5 Aluminum alloy spindle pulley permits speeds above 5000 r.p.m.
6 One piece head casting, bored in line.
7 Pulleys and belt amply guarded, yet easily available.
8 Steel quill turned from bar, seats bored and rack milled in quill.
9 One piece feed pinion and shaft, with teeth cut on gear hobber.
10 One-shot lubrication — oil applied at one point only.
11 No. 2 Morse Taper Spindle Nose.
12 Power feed take-off pulley. Feed coordinated with spindle speed.



The sectional view above illustrates the careful design that provides an unusually smooth-running spindle in Walker-Turner 20" Drill Presses. These rugged production machine tools are in use in great numbers in war industries today. Due to their versatility, many have been applied in special tooling set-ups of various kinds. Simplicity of controls permits their use by unskilled and semi-skilled labor — an important point under present conditions as well as in the post-war period.

Send for descriptive literature

WALKER-TURNER CO., INC., 1824 Berckman Street, PLAINFIELD, N. J.

Furnished in bench, floor and multi-spindle models — with or without power feed. Capacity ¾" in steel, 1" in cast iron. Spindle speeds 260 to 2600 r.p.m.

PROGRESS THROUGH INTENTION

Announcing

A NEW CUTTING COMPOUND

1. Increases production from 25 to 100 per cent.
2. Lengthens cutting tool life from 2 to 10 times.
3. Increases tap life from 5 to 20 times.

An increased production from 25 to 100 per cent is due to the higher cutting speeds which may be used and makes it possible to increase the tool life 2 to 10 times before regrinding is necessary. It also gives a finish far superior to any other compounds.

It is particularly recommended for difficult tapping operations and various types of threading on Dural and Chrome Molybdenum where difficulty has been experienced in producing clean threads.

This new compound is being used successfully for particular use on hard steels such as high speed tool steels and Chrome Molybdenum and the new national emergency alloys.

Price $2.00 per gallon in 50 gallon drums, and $3.00 per gallon for smaller lots.

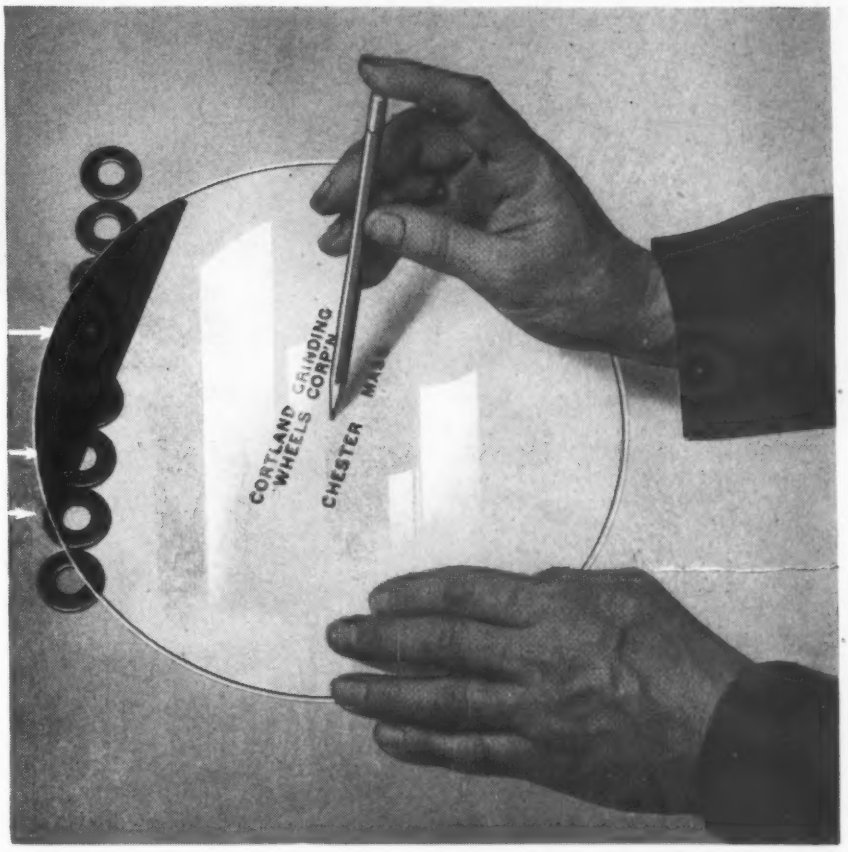
Look to Fearless for new and modern developments in the future.

FEARLESS OIL COMPANY

325 West 11th Street, Los Angeles 15, Calif.

ANOTHER FEARLESS PRODUCT

He looked through this Disc and found the Answer . . .*



He was a harassed manufacturer, in the midst of renegotiation. Not a particularly good time to call and try to talk about grinding wheels . . .

"Grinding Wheels? Hell — I need *lapping* compounds! Look at these specifications: S.A.E. 52100 — 63–65 Rockwell C scale – *surface finish 2 micros* — and production's gotta be stepped up! . . . *What's that thing?*"

"Just a piece of clear plastic. It represents the segments in your vertical spindle grinders. Now imagine that these washers are the *work* on your tables. Would you mind rotating this disc counter-clockwise . . . slowly . . . **1** See how the narrow end of the Cortland Segment starts to pass over the work? Shock and resistance minimized; large surface still exposed to coolant . . .

"Keep going . . . **2** Watch the action of the straight inner edge of the segment — See how it travels *diagonally* over the work? We call it *Diagonal Shearing* — with varying contact it *shaves* off the metal . . .

"Keep going . . . **3** Now the segment is in full surface contact with the work. Maximum heat is generated, but only momentarily, because as the segment continues to pass across the work, more and more of the ground surface is again exposed to the action of the coolant.

"That's the story back of the success of Cortland Chucks & Segments — *Diagonal Shearing* with varying contact — for better, faster cutting; minimum shock; maximum area exposed to coolant; and ground material swept aside. Better surface grinding, less segment wear, less power needed, lower overhead and maintenance . . . All good answers, don't you think?"

★ ★ ★

* . . . the Answer to a problem in Surface Grinding. The problem may involve a Profilometer reading of 2 microinches; or hardened steel parts that heat and squeal; or table loads that take too long to grind or require too much amperage, or need too many segment dressings. . . . You'll find these problems *solved* — and many more in the true case histories presented in the Cortland Chuck & Segment Bulletin. For a free copy write on your letterhead to

Cortland Grinding Wheels Corporation
8 Cortland Street, Chester, Massachusetts

CORTLAND
Chucks and Segments

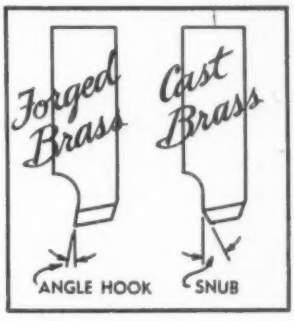
HARDINGE Precision Collets
for all makes of Lathes and Milling Machines
HARDINGE
ELMIRA, N.Y.
Style "B" Master Feed Fingers and Pads
HARDINGE Precision Collets and Feed Fingers for
all makes of Automatics, Turret Lathes and Chucking Machines
Style "S" Sure Grip
Master Collets and Pads
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

KINKS FROM GEOMETRIC

ON HOW TO SAVE HIGH SPEED STEEL ...AND GET BETTER THREADING!

don't use the wrong cutting face grind for the job at hand, or buy chasers from which metal has to be ground in order to secure the correct rake angle.

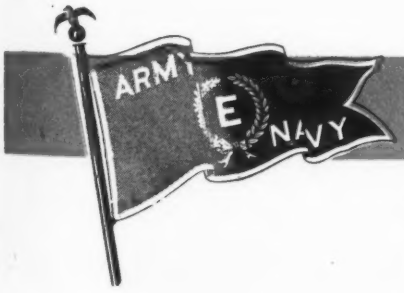
do specify and use the face grind best suited to the job. For example: Forged Brass requires Angle Hook, but Cast Brass needs Snub grind, with stronger cutting edge.*



ANOTHER GOOD KINK!

The Geometric Tool Company is listed on the Treasury Department's Roll of Honor of those companies whose employees contribute at least 10% of their earnings, through the Payroll Savings Plan, for War Bonds. Buy War Bonds and Stamps each payday!

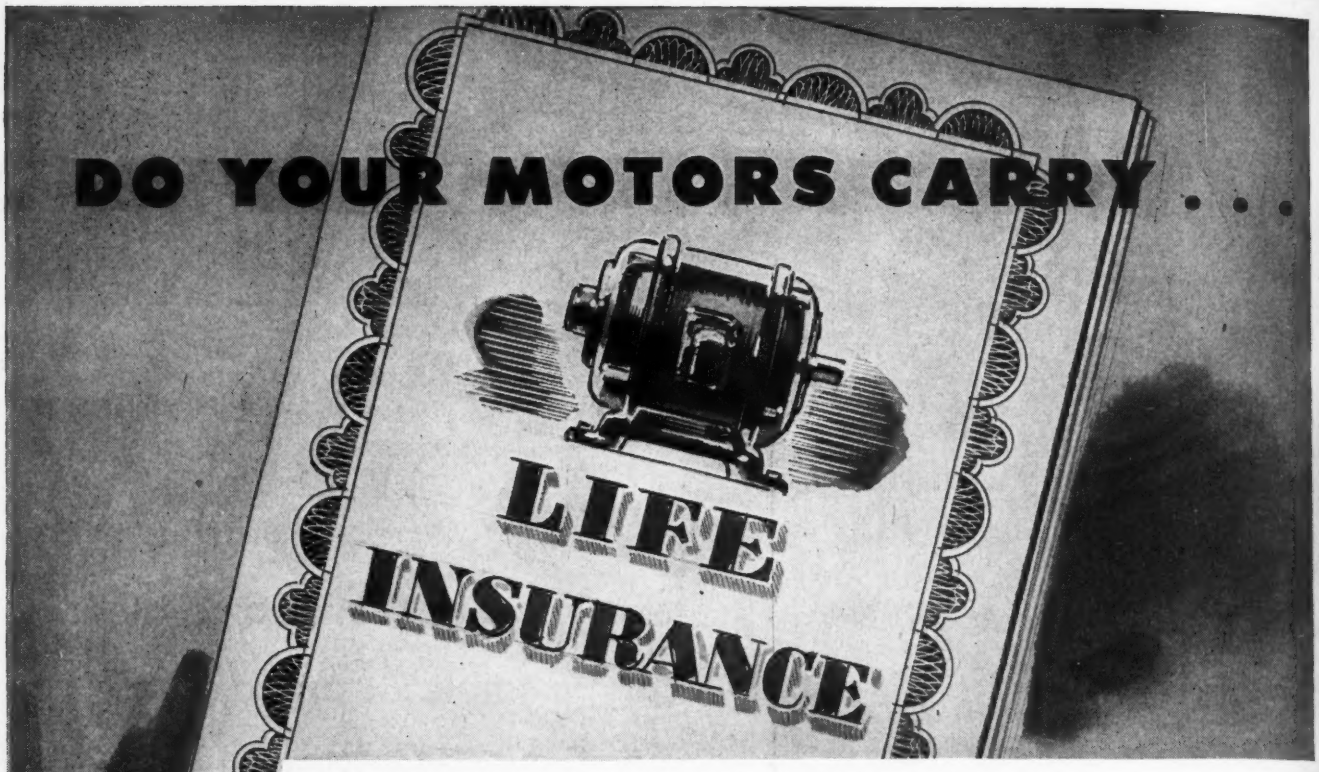
* Remember — different materials require different face grinds. Use the correct rake angle, get better threading, save precious high speed steel! Here are proper rake angles for some of the more common metals: Cast Brass requires snub or negative rake. Forged Brass, same angle hook as for steel. Copper, radial hook or radial lip hook. Cast Bronze, straight grind. Free cutting steels, slight angle hook. For tougher alloy steels, stainless steels, steel forgings, stampings, hook must be increased according to analysis of material. The manufacturer of your chasers will help you determine the correct face grind for each type of work. THE GEOMETRIC TOOL COMPANY, NEW HAVEN 15, CONNECTICUT.



GEOMETRIC

SELF-OPENING DIE HEADS
COLLAPSING TAPS
CHASER GRINDING MACHINES

SOLID ADJUSTABLE DIE HEADS
SOLID ADJUSTABLE TAPS
THREADING MACHINES



The life of a motor is no longer than the life of its bearings. Bearing failure means motor failure and shutdowns. And the bearings may fail for any or all of the following reasons:—(a) poor design and construction; (b) neglected lubrication; (c) use of lubricant of poor quality; (d) dust and dirt in the bearings.

MOTOR MANUFACTURERS WHO HAVE ADOPTED NORMA-HOFFMANN "CARTRIDGE" BALL BEARINGS ARE PROVIDING THEIR CUSTOMERS IN-BUILT MOTOR LIFE INSURANCE--IN EFFECT, A GUARANTEE OF LONGER, MORE TROUBLE-FREE, LOWER-COST MOTOR PERFORMANCE—because:—

A. The "CARTRIDGE" BEARING is a NORMA-HOFFMANN PRECISION product, designed EXPRESSLY to meet electric motor requirements.

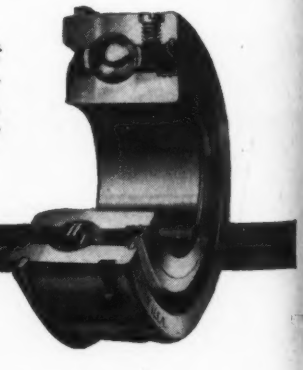
B. With its double-row width, the "CARTRIDGE" BEARING provides WITHIN ITSELF a supply of lubricant at least twice that of any other single-row ball bearing.

C. The "CARTRIDGE" BALL BEARING is loaded at the factory with NORMA "STABILITY-TESTED" GREASE—a high-duty lubricant which has exceptional life and a wide temperature range, and moreover is chemically stable and water-repellent.

D. The highly efficient, wearless metal seals of the "CARTRIDGE" BEARING, so effective in KEEPING LUBRICANT IN the bearing, are equally effective in KEEPING DUST AND DIRT OUT. And they are removable and replaceable, making bearing inspection easy.

These, and other, distinctive features explain why so many motor manufacturers, seeking to assure their customers MAXIMUM MOTOR LIFE, have adopted NORMA-HOFFMANN "CARTRIDGE" BALL BEARINGS for their latest and most efficient motor models.

Ask for motors carrying the "life insurance" that NORMA-HOFFMANN "CARTRIDGE" BEARINGS provide. They will be a sound and lasting investment, returning good dividends in lower costs, longer life, and freedom from shutdowns.



NORMA-HOFFMANN BEARINGS CORP'N, STAMFORD, CONN. FOUNDED 1911

TO WIN THE WAR • WORK • FIGHT • BUY WAR BONDS

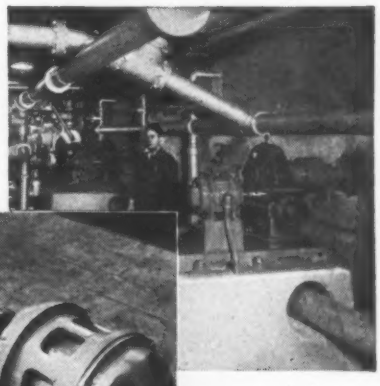
WE CERTAINLY MAKE A LOT OF DIFFERENT TYPES OF SPEED REDUCERS..

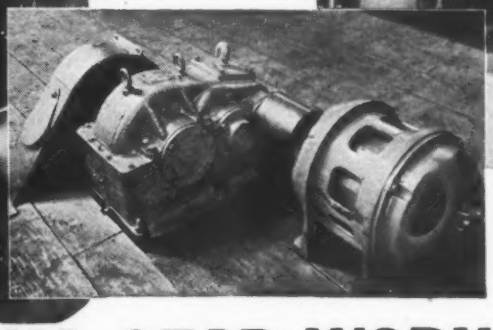
YES, THAT'S WHY WE CAN SUPPLY A DRIVE FOR EVERY NEED!

Long ago, experience showed that the many industrial drive applications could be filled best only from a full line of speed reducing units—therefore we designed and make all types and sizes. Furthermore, each unit is tailored to fit the service. In that way Philadelphia Speed Reducers transmit power efficiently and economically to all kinds of equipment and give years and years of trouble-free service.

Where a self-contained drive is indicated, we recommend the vertical or horizontal MotoReduceR.

Tell us your requirements and get our unbiased recommendations on the right type drive for your needs



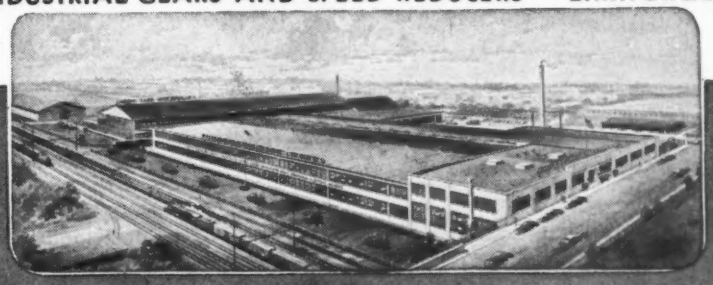


Shown here are 2 Philadelphia Speed Reducer installations.

PHILADELPHIA GEAR WORKS, INC.

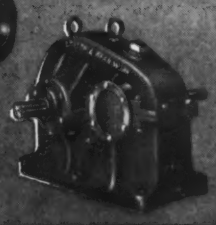
INDUSTRIAL GEARS AND SPEED REDUCERS · LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA 34, PENNA.
NEW YORK, PITTSBURGH, CHICAGO



Philadelphia LIMITORQUE CONTROL operates all types of valves, etc., safely, economically, from convenient stations.

Philadelphia GEARS All types and sizes of industrial gears. Can be supplied in all materials.



Philadelphia HERRINGBONE SPEED REDUCER for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

Philadelphia MOTOREDUCER The economical self-contained drive. Horizontal or Vertical types — various ratios and horsepowers.

Philadelphia WORM GEAR SPEED REDUCER right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

Industry's new tooth ...is sharpened with

DI-MET DIAMOND ABRASIVE WHEELS

NOT so many years ago high speed steel almost universally supplanted carbon steels for cutting tools. Now industry has new cutting teeth far more efficient and productive than even the "high speed" tools. Due to their extreme hardness, cemented carbides successfully machine all types of metals with a speed and efficiency never before attained. In fact, their hardness almost *demands* the use of diamond wheels to quickly and accurately grind the keen, smooth cutting edges so vital to high production.

DI-MET resinoid bonded diamond abrasive wheels were specially developed for carbide applications. Their super-tough, wear-resistant resinoid bond cuts fast and cool, resists severe abuse without cracking or chipping and will not craze the carbide surfaces. Smooth, finished cutting edges are easily obtained without subsequent honing and, because DI-MET wheels maintain their size over long periods, accurate sizing of multiple toothed cutters is automatically produced without individual gauging of the separate teeth.

DI-MET resinoid bonded diamond abrasive wheels are highly economical on all carbide applications because of their extra long life, rapid metal removing ability and more accurate grinding results. Made in all standard types and sizes up to and including 6" in diameter. Our new catalog illustrates types, lists sizes and prices and offers valuable diamond wheel operating tips. Write for your free copy.

FELKER DI-MET ARMY E NAVY

FELKER MANUFACTURING CO.
1113 BORDER AVE., TORRANCE, CALIF.

MANUFACTURERS OF DIAMOND ABRASIVE WHEELS

They're TOUGH— but they need Care

GOOD CUTTERS CAN MEET TODAY'S PUNISHING DEMANDS— BUT THEY NEED CARE TO DO IT.....

1. Use the proper spindle speed. Remember small cutters need faster speeds.
2. Maintain the correct clearance for material being machined.
3. Use collars of the same diameters on each side of saws or thin milling cutters.
4. Clean shanks of arbors and adapters.
5. Use adequate arbor support.
6. Clamp work securely.
7. Mount cutters as close as practicable to spindle.
8. Use sharp cutters — a dull cutter wears excessively.

These simple suggestions will help cutters maintain high production rates and give long wear — and aid in delivering a greater volume of armament to our fighting forces.

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

Reproductions of this advertisement for use on your bulletin boards furnished on request.

BROWN & SHARPE CUTTERS

SURE, that Saturday night pay envelope's bulging. But let me tell you something, brother, before you spend a dime . . . *That money's mine too!*

I can take it. The mess out here. And missing my wife and kid.

What I *can't* take is you making it tougher for me. Or my widow, if that's how it goes. And brother, it *will* make it tough—if you splurge one dime tonight. You're making money. More money than there's stuff to buy. Money that can sock the cost of living to kingdom come—if you blow it! So hang on, till the job's done. On to every last dime—till the squeal means a hole in the seat of your pants!

You're working . . . and *I'm fighting* . . . for the same thing. But *you* could lose it for both of us—without thinking. A guy like you could start bidding me right out of the picture tonight. And my wife and kid. There not being as much as everybody'd like to buy—and you having the green stuff. But remember this, brother—everything you buy helps to send prices kiting. Up. UP. AND UP. Till that fat pay envelope can't buy you a square meal.

Stop spending. For yourself. *Your* kids. And mine. That, brother, is sense. Not sacrifice.

Know what I'd do with that dough . . . if I'd the luck to have it?

I'd buy War Bonds—and, God, would *I* hang on to them! (Bonds buy guns—and give you four bucks for your three!) . . . I'd pay back that insurance loan from when Mollie had the baby . . . I'd pony up for taxes cheerfully (knowing they're the cheapest way to pay for this war) . . . I'd sock some in the savings bank, while I could . . . I'd lift a load off my mind with more life insurance.

And I wouldn't buy a shoelace till I'd looked myself square in the eye and knew I couldn't do without. (You get to knowin'—out here—what you can do without.)

I wouldn't try to profit from this war—and I wouldn't ask more for anything I had to sell—seeing we're all in this together.

I've got your future in my rifle hand, brother. But you've got both of ours, in the inside of that stuffed-up envelope. You and all the other guys that are lookin' at the Main Street shops tonight.

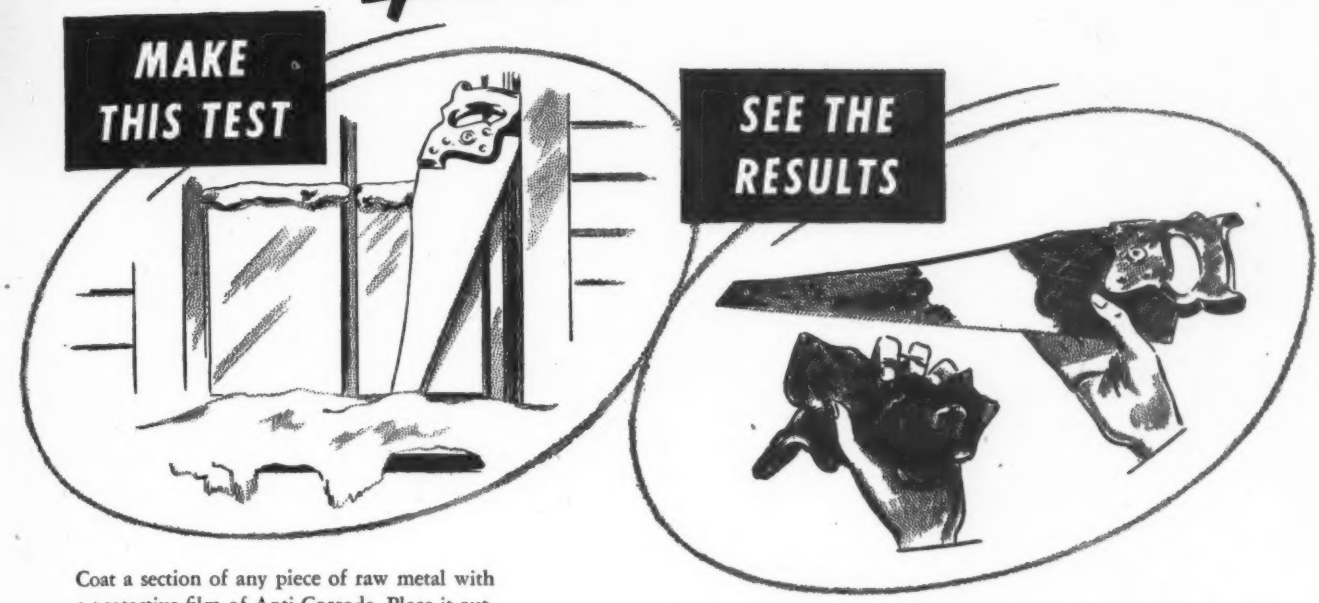
Squeeze that money, brother. It's got blood on it!

Use it up . . . wear it out, make it do...or do without

HELP US KEEP PRICES DOWN

A United States war message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by the Magazine Publishers of America

How to *prevent* Corrosion



Coat a section of any piece of raw metal with a protective film of Anti-Corrode. Place it out-of-doors, and leave exposed to the elements.

Rain, snow, changing temperature, dust and grime have eaten into and oxidized the unprotected metal. But note surface under Anti-Corrode film—bright and unharmed, in its original state.

CITIES SERVICE **ANTI-CORRODE** is a safe rust and corrosion preventive that brings amazing results. It is a reliable safeguard against corrosion of metals in any form or state of finish—whether in storage or in transit. Anti-Corrode forms a tenacious, durable film that is impervious to moisture and the more common gases prevalent in the atmosphere. And, since it contains lubricating material, it need not be removed in drawing operations. Anti-Corrode is made in several grades to meet specific requirements and severest tests. It is economical, easy to apply and can be removed with kerosene or any petroleum solvent.

This TEAM Will Save You Money and Materials

Recently, we announced the development of Cities Service Rust Remover, and responses to the demonstration offer far exceeded our expectations. Rust Remover, of course, *removes* rust. Anti-Corrode is designed to *prevent* rust and corrosion. Together, they will safeguard your equipment and war production—for the duration!

Take advantage of this FREE ANTI-CORRODE demonstration offer
Mail this coupon today!

(*Available only in Cities Service marketing territory EAST of the Rockies.*)

CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO
IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

CITIES SERVICE OIL COMPANY
Room **133,** Sixty Wall Tower, New York 5, New York

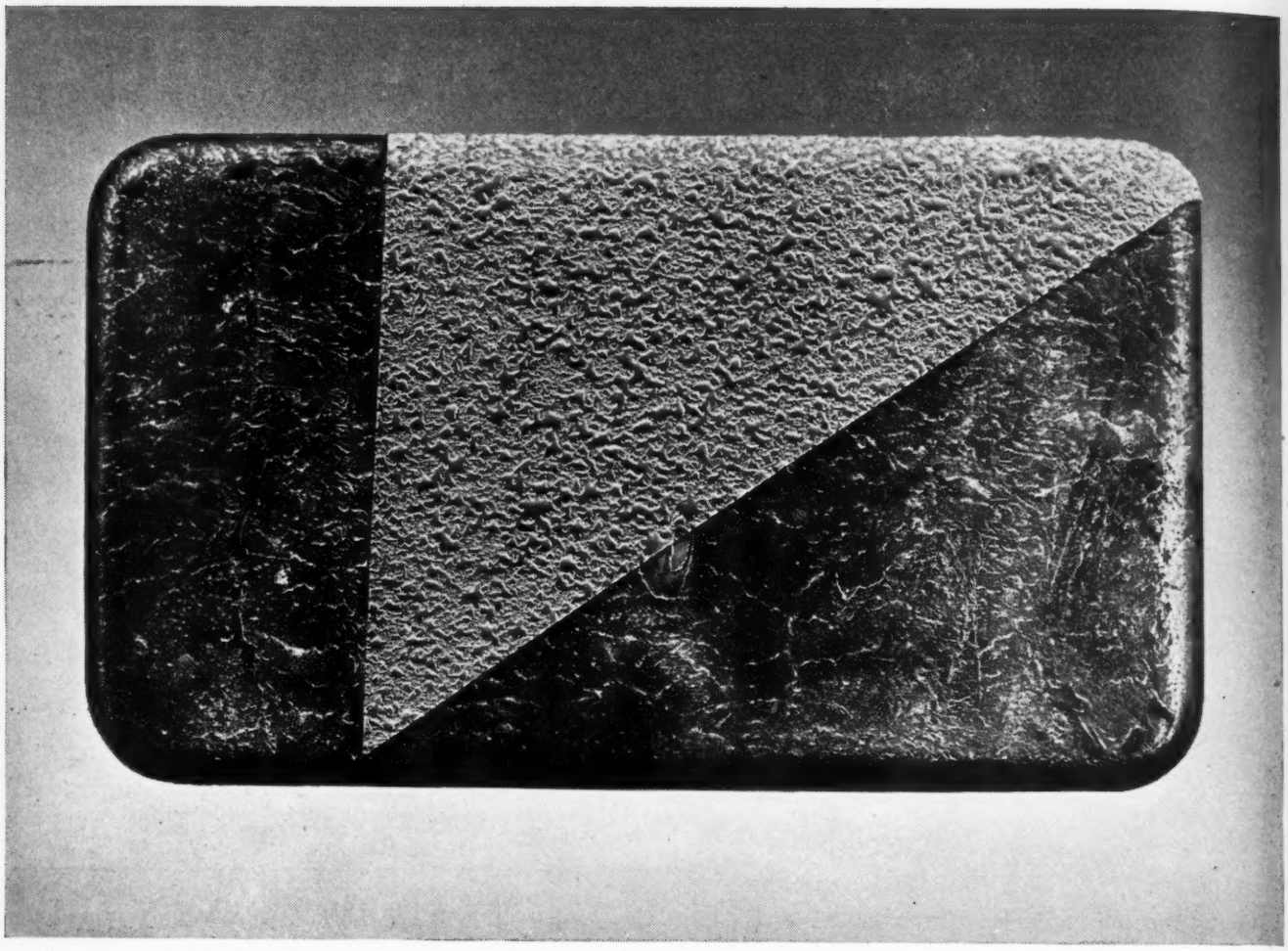
Gentlemen: I would like to test Anti-Corrode on my own equipment FREE OF CHARGE. Please send me the details.

Name_____

Company_____

Address_____

City_____ State_____



Lowe Brothers Modern Texture Finish For Rough Castings

The fine finishes on the majority of machine tools before the War were designed by The Lowe Brothers Company. They not only protected the machines from cutting liquids but also provided a finish that commanded the respect of operators and insured the proper care so necessary to their best performance.

Fine tools were deprived of this quality finish when Limitation Order L-108 prohibited filling operations. The Lowe Brothers Company met the emergency within a few weeks by developing MODERN TEXTURE, *the pebble finish which camouflaged the rough cast surface and gave a tough, protective finish that fully complies with the Limitation Order.*

MODERN TEXTURE *finish has many outstanding characteristics which make it an excellent finishing system—not only for machine tools, but for any cast iron equipment where the cost of a smooth filled job is prohibitive. It eliminates filling, requires no baking, and yet produces an excellent finish with either two or three coats.*

Investigate this new finish now for the answer to your finishing problems—present and future. You can rely on Lowe Brothers broad experience with government specifications for machine tool finishes and industrial finishes of every type.

★ ★ ★

INDUSTRIAL SALES
THE LOWE BROTHERS COMPANY
DAYTON, OHIO

Lowe Brothers
WARTIME FINISHES *for Industry*

IN ACCORDANCE WITH U.S. GOVERNMENT SPECIFICATIONS

Preselecting the Speed

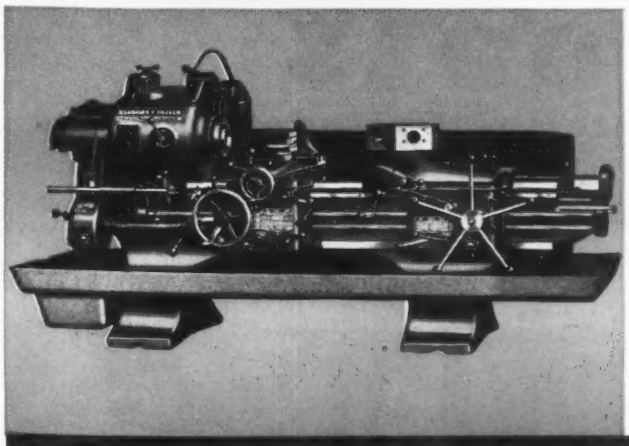
FOR THE NEXT CUT

Means not only more parts produced at the end of the day. It also means that the operator feels less fatigued and more able to enjoy his hours of leisure.

Merely turn the drum type dial while the machine is working. Select either the spindle speed in revolutions per minute or the cutting speed in feet per minute for the next cut. Then when the feed drops out change without delay to the new speed.

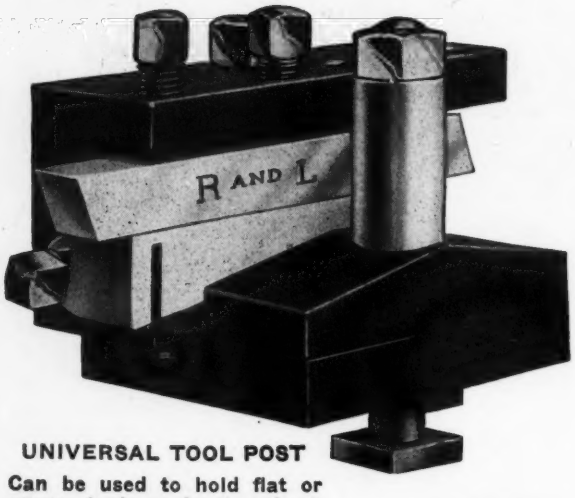
This and many other outstanding features of the BARDONS & OLIVER NO. 21 SADDLE TYPE UNIVERSAL TURRET LATHE are described in the new catalog.

Write for your copy today.



BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO



UNIVERSAL TOOL POST

Can be used to hold flat or square tools on front or back cross-slide with the spindle running either direction.

R & L TURNING TOOL

Shown set up for drilling, turning and burnishing. The Tantalum Carbide backrest may be removed and the new Roller Backrest, shown below, substituted.

RIGHT R AND L LEFT

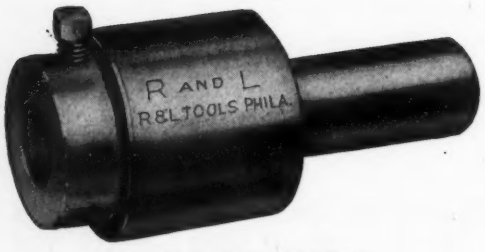
CAN DOUBLE MACHINE CAPACITY . . . *Instantly!*

On many screw machine and turret lathe jobs, R&L Tools enable you to double output instantly! The R&L Turning Tool, for instance, makes one tool do the work of two—or three. With it you can perform drilling and turning; turning, centering and burnishing; turning two diameters, and many other combinations of operations. The Universal Tool Post reduces set-up time because it can be used on front or back cross-slide with the spindle running in either direction. Similarly, the Tap and Die Holder operates equally well on right or left hand threading jobs . . . And all R&L Tools are simply designed, with a minimum of wearing parts; ruggedly built for a long life of accurate work. Use them to increase output . . . to reduce tooling costs and time . . . to cut down maintenance costs.

The R&L Booklet will give you complete details; write for it!

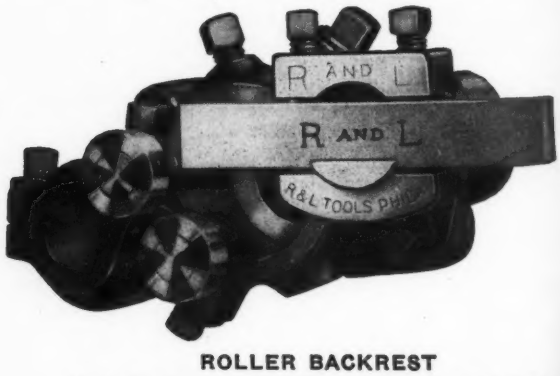
R AND L TOOLS

1825 BRISTOL STREET, Nicetown, Philadelphia, Pa.



TAP AND DIE HOLDER

New design eliminates spring plungers and small screws. Engaging teeth separate fully—and instantly—when released, reducing wear.



ROLLER BACKREST

Made in five sizes to fit the five sizes of R & L Turning Tools. Easily set up for either right or left hand turning.

Basis For Confidence

American flyers aloft are trusting their lives to the precision workmanship of those who build their planes back home. And to the capacity of those builders to support this skill with the prodigious **number** of planes they need. Two axioms of war which underscore the fact that—

More Bullard Vertical Turret Lathes are in use by America's builders of airplane engines than in any other industry.

• Bullard Vertical Turret Lathes

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

ARRESTS PROGRESSIVE WEAR

It is hard to conceive that contacting surfaces can be operated against each other and not cause wear. But tests prove this is not unusual when LUBRIPLATE Lubricants are used. This "Modern Lubricant" is more than top quality petroleum. It contains elements not found in any other oils or greases.

LUBRIPLATE maintains a wear-resisting, load-bearing film on shafts, bearings, gear teeth and other contacting moving machine parts. The destructive consequences of friction are therefore reduced to an unbelievable minimum. LUBRIPLATE protects machine parts against rust and corrosion. Its long life and stay-put properties make LUBRIPLATE very economical.

Don't take our word for the above statements. Let us send you data from scientific tests and case histories that prove that LUBRIPLATE arrests progressive wear. Write for a copy of "The LUBRIPLATE Film" written especially to serve your industry.

Rx FOR YOUR MACHINERY

No. 3—Ideal for general oil type lubrication. Ring oiled bearings, wick feeds, sight feeds and bottle oilers.

No. 8—Because of its high film strength and long life reflects outstanding performance in most types of enclosed gears (speed reducers).

No. 107—One of the most popular grease type products for general application by pressure gun or cups.

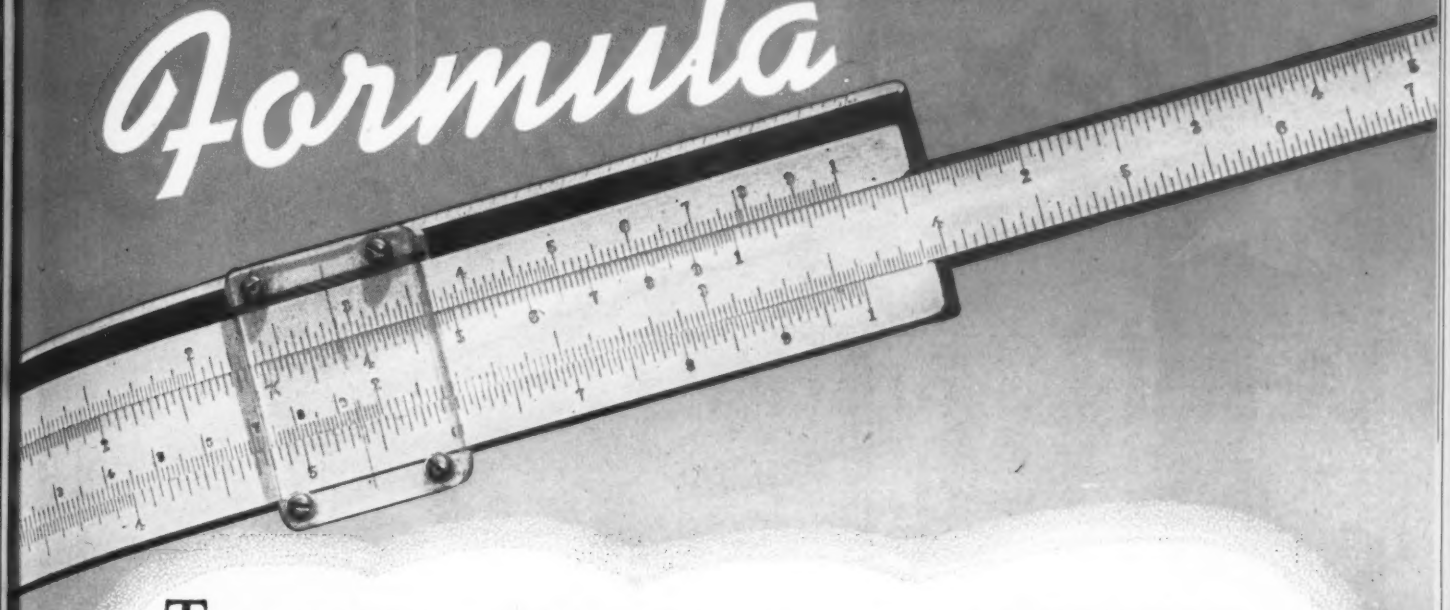
No. 70—For a wide range of grease applications, especially at temperatures above 200 degrees F.

No. 130-AA—Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING—This is the LUBRIPLATE lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.

LUBRIPLATE DIVISION
FISKE BROTHERS REFINING COMPANY
NEWARK, N. J. **SINCE 1870** TOLEDO, O.
WRITE FOR THE NAME OF THE DEALER NEAR YOU

No Slide Rule Formula



The Cleveland Automatic Machine Company's "Production Cost Patrol" is an engineering service. Its purpose is to provide a competent "outside approach" to your turning and forming problems, and, working in co-operation with your production experts, to seek out hitherto undiscovered waste in production methods.

Engineers who would come to your plant to perform this service do not merely ask a few questions, whip out a slide rule and a convenient formula for making changes. Instead, a thorough study of methods is made. Wherever possible, specifications of pieces in production are taken and samples produced by methods our engineer works out. If the new method affords improvements in cost and production, you are given a full report on the comparison between present and proposed methods, detailing every unit of time, manpower and equipment involved . . . showing not only HOW but WHY.

The steps to bring about such a study in your plant are simple . . . (1) Upon request you will be given a statement of our engineer's method of surveying your plant, and his credentials will be submitted. (2) The engineer will spend as much time as necessary in your plant, making detailed studies, without interrupting production. (3) A detailed written report will be made for you, with proposals for changes in method wherever opportunities for savings are found.

Write or wire for further information

THE CLEVELAND AUTOMATIC MACHINE COMPANY

CLEVELAND, OHIO

SALES OFFICES

CHICAGO: 1408 Civic Opera Building
DETROIT: 540 New Center Building
NEWARK: 902 American Insurance Building
CINCINNATI: 1315 American Building

how's YOUR quota?

. . . YOUR 4TH WAR LOAN QUOTA

WHETHER your plant meets its quota, or fails, lies largely in *your* hands. Your leadership can put it over—but if you haven't already got a smooth running, hard hitting War Loan Organization at work in your plant, there's not a minute to lose.

Take over the active direction of this drive to meet —*and break*—your plant's quota. And see to it that every one of your associates, from plant superintendent to foreman, goes all-out for Victory!

To meet your plant's quota means that you'll have to hold your present Pay-Roll Deduction Plan payments at their all-time high—plus such additional amounts as your local War Finance Committee has assigned to you. In most cases this will mean the sale of *at least* one $100 bond per worker. It means having a fast-cracking sales organization, geared to reach personally and effectively every individual in your plant. And it means hammering right along until you've reached a 100% record in those *extra* $100 —or better—bonds!

And while you're at it, now's a good time to check those special cases—*growing more numerous every day*—where increased *family* incomes make possible, *and imperative,* far greater than usual investment through your plant's Pay-Roll Deduction Plan. Indeed, so common are the cases of two, three, or even more, wage-earners in a single family, that you'll do well to forget having ever heard of '10%' as a reasonable investment. Why, for thousands of these 'multiple-income' families 10% or 15% represents but a paltry fraction of an investment which should be running at 25%, 50%, or more!

After the way you've gone at your wartime *production* quotas—and topped them every time—you're certainly not going to let anything stand in the way of your plant's breaking its quota for the 4th War Loan! Particularly since all you are being asked to do is to sell your own people the finest investment in the world—*their own share in Victory!*

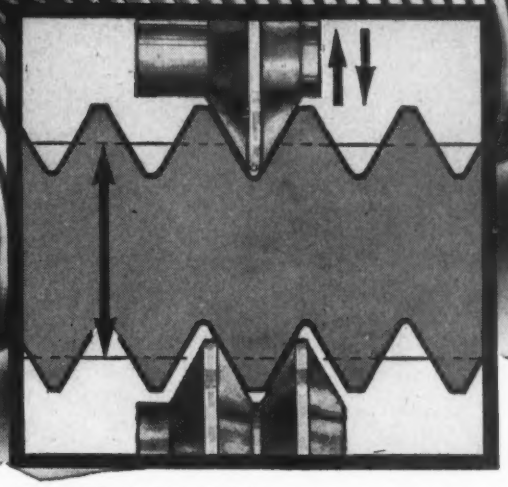
LET'S ALL BACK THE ATTACK!

This space contributed to Victory by

MACHINERY

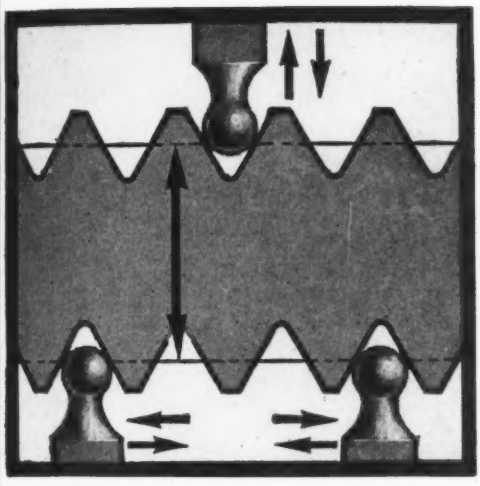
This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.

A Faster Way to Inspect PITCH DIAMETERS



Positively, More Accurately and to closer tolerances

MODEL 45B-100. The upper, sensitive roller contact actuates the Dial Indicator.



MODEL 45B-80. The upper, sensitive ball contact actuates the Dial Indicator. Both lower ball anvils float sidewise independently to compensate for any variation in lead.

No conventional type of gage, whether ring gage or roller-type snap gage, can tell you so **definitely** and so **quickly** the degree of accuracy of a pitch diameter as these two types of Dial Indicator Gages. Neither depend upon the uncertain sense of touch.

The roller type tells more than the conventional roller snap gage because the sensitive upper roller contact, reveals on the Indicator, just **how much** and **where** the pitch diameter may be wrong. The ball type simulates the three-wire method, but is faster. It is accurate to a tenth of a thousandth. Either type is incorporated in the adjustable Dial Indicator Gage shown below. For details write—

TWO FULL COLOR FILMS
(With Sound)
No. 1 DIAL INDICATORS
No. 2 DIAL INDICATOR GAGES
20 minutes each. For instruction and training. For showing write →

FEDERAL PRODUCTS CORPORATION
PROVIDENCE 1, RHODE ISLAND

CHICAGO • CLEVELAND • DETROIT • DALLAS • HARTFORD • HOUSTON • INDIANAPOLIS • LOS ANGELES MEMPHIS • MILWAUKEE • MINNEAPOLIS • MONTREAL NEW YORK • PHILADELPHIA • PITTSBURGH ROCHESTER • SAN FRANCISCO • ST. LOUIS • TORONTO WINDSOR

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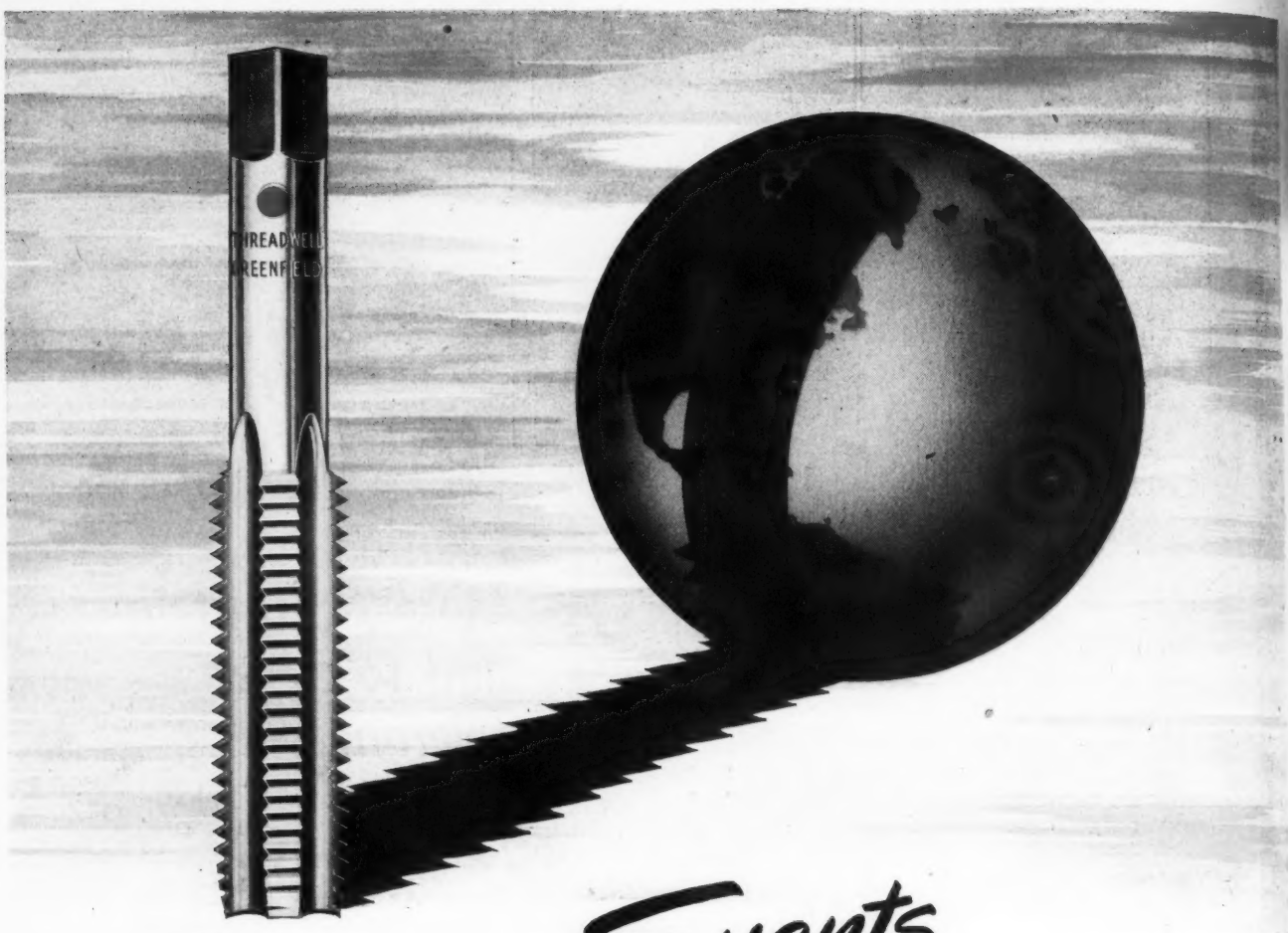
PRECISION MEASURING INSTRUMENTS



Coming Events

CAST THEIR SHADOWS BEFORE!

ALREADY the outlines of a great and prosperous future are taking form in the minds and plans of American industry. At hand are new and better tools, created to meet the exacting demands of war production, ready to be converted to peace. A bright star has risen on the small tool horizon during the war . . . a better, more accurate, longer lived threading tool . . . the *Threadwell Tap*. In months to come it will help many of America's leading industries make a better product at less cost.

DISTRIBUTORS IN LEADING INDUSTRIAL CENTERS
THROUGHOUT AMERICA

★

EXPORT STOCKING DISTRIBUTORS
CANADA *Bridge Machinery Co., Montreal*
ENGLAND *Skylux Ltd., London*
and
John H Graham and Co., Inc.
THROUGHOUT THE WORLD

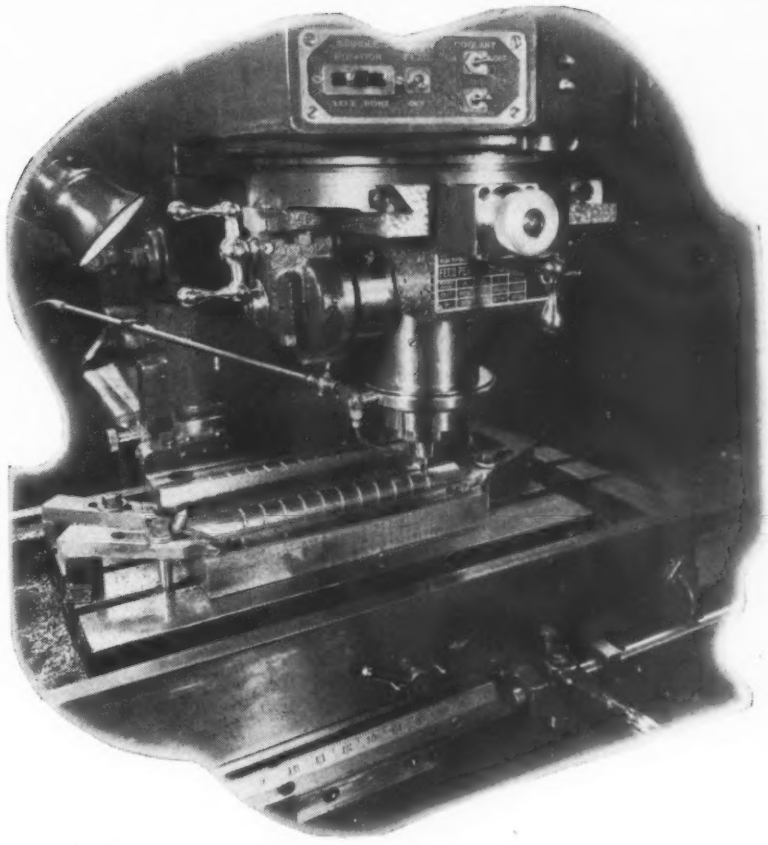
Threadwell
"TAPS OF DISTINCTION"

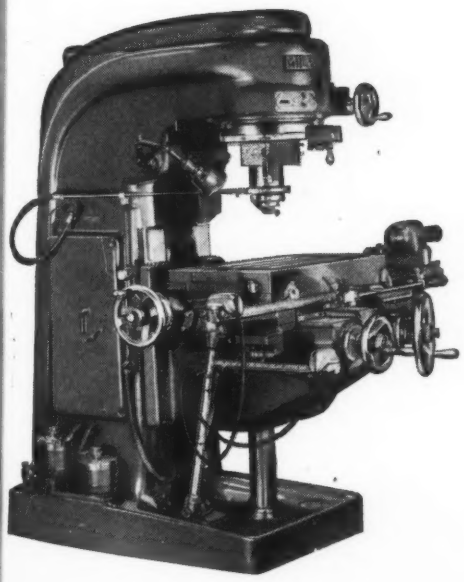
THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U.S.A.

ROTARY HEAD MILLER . . . PLUS CHERRYING ATTACHMENT . . . SIMPLIFIES THIS "*TRICKY*" MILLING OPERATION

The Milwaukee Rotary Head Miller equipped with a cherrying attachment made "short work" of the "*tricky*" milling required on this injection mold. It took just two hours to complete the job — far less time than by any other method known.

The cherrying attachment is an auxiliary rotary head, mounted at 90° to the head of the miller. It is used to mill circles and angles in a vertical plane. When used with rotary head motion, spherical and conical cavities can be accurately and rapidly milled — in almost all cases difficult operations become a comparatively simple task.





KEARNEY & TRECKER'S ROTARY HEAD MILLER

The Most Versatile Machine Ever Designed for Mold and Die Work

DIRECT . . . mills mold cavities in a single set-up without the aid of templets or models.

ACCURATE . . . chances for error are eliminated because there is no change in set-up. Exact control of all combinations of cutting movements —possible only with this machine— transmits mathematical precision to the work.

FAST . . . initial job preparation and set-up time is reduced to the minimum. Accurate performance of the machine saves operator's time and rapid production of intricate molds and dies is the result.

Write for Bulletin No. 1002C for complete information on the Milwaukee Rotary-Head Miller and the accurate and rapid production of all types of molds and dies.

Rotary Head Milling Machine
•
Autometric Jig Borers
•
Center Scope

Kearney & Trecker *Products*
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
•
Milwaukee Midgetmill
•
Milwaukee Speedmill

INVEST IN V

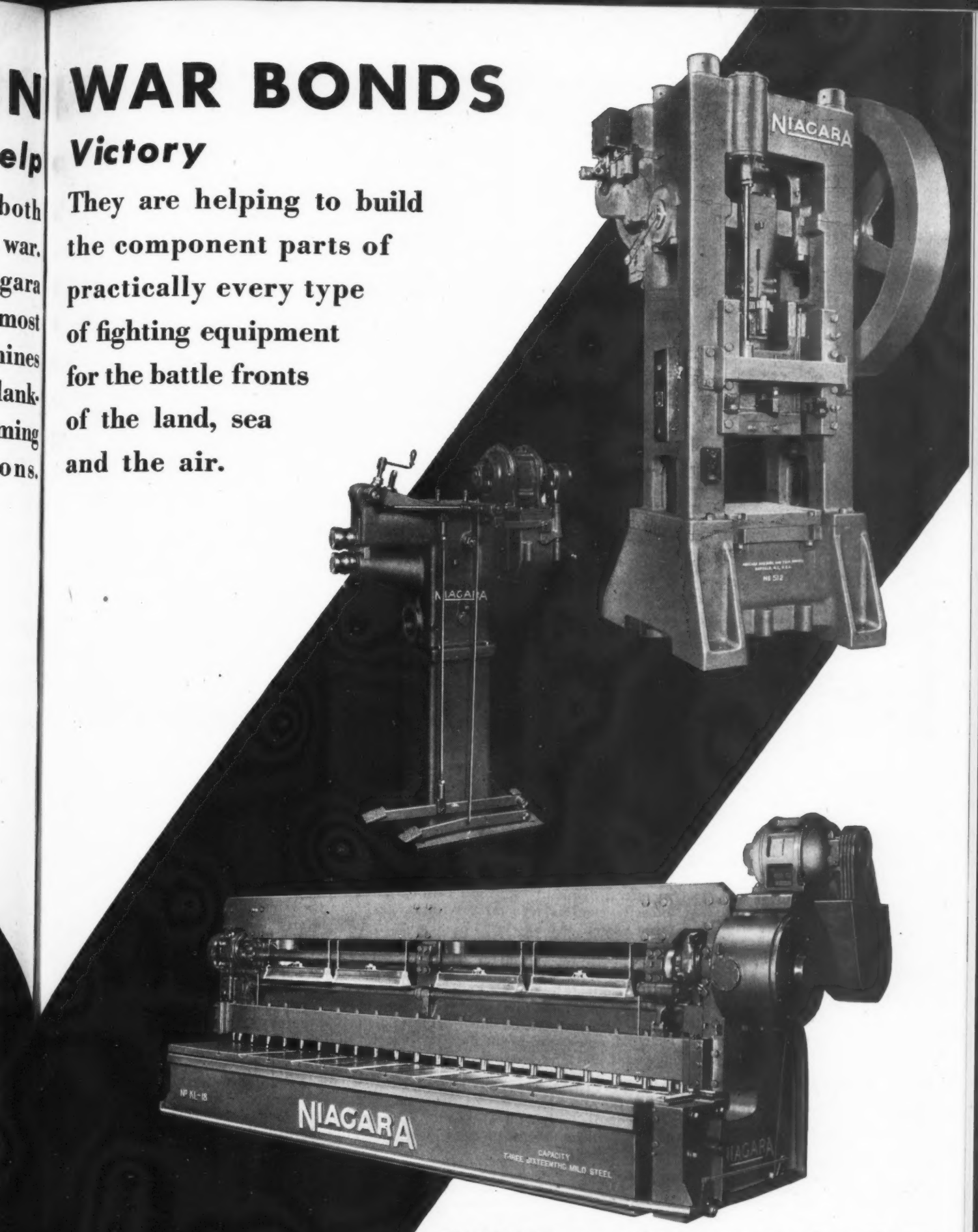
and Help V

Men and money are both essential sinews of war. The complete Niagara line provides the most productive machines for shearing, blanking and forming operations.

WAR BONDS

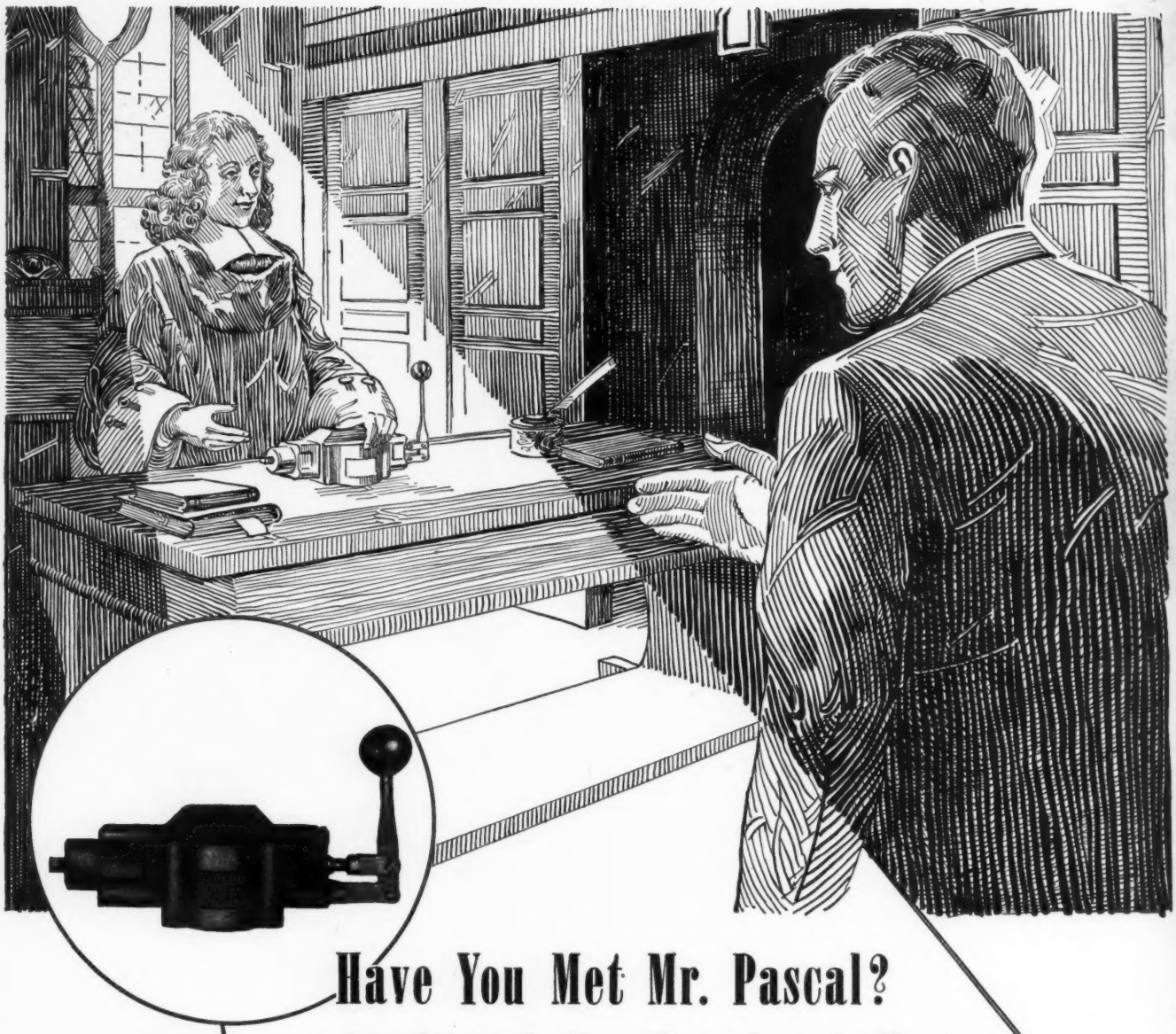
Victory

They are helping to build the component parts of practically every type of fighting equipment for the battle fronts of the land, sea and the air.



NIAGARA MACHINE AND TOOL WORKS
BUFFALO, N. Y.

District Offices . . . Cleveland, Detroit, New York



Have You Met Mr. Pascal?

Or perhaps we should say, "Do you know what Mr. Pascal's discovery offers you?"

More than three hundred years ago, Blaise Pascal said, in effect, "Pressure applied at any point on a fluid in a closed vessel is transmitted *undiminished* to all parts of that vessel." And today, Pascal's law is being translated into some of the most ingenious machinery and equipment in the whole history of industrial development.

Denison oil-hydraulic engineers bring this principle to its most advanced stage . . . in HydrOILics! Their application of fluid power, and exact control of that power, has not only resulted in many new products, but has also brought greater accuracy, speed and efficiency to hundreds of already established production tasks.

More than likely HydrOILics . . . Denison oil-hydraulics . . . offers improvement for your product, or its manufacture. Our engineers will gladly help you find out. Write at once for complete information. The Denison Engineering Company, 1152 Dublin Road, Columbus, Ohio.

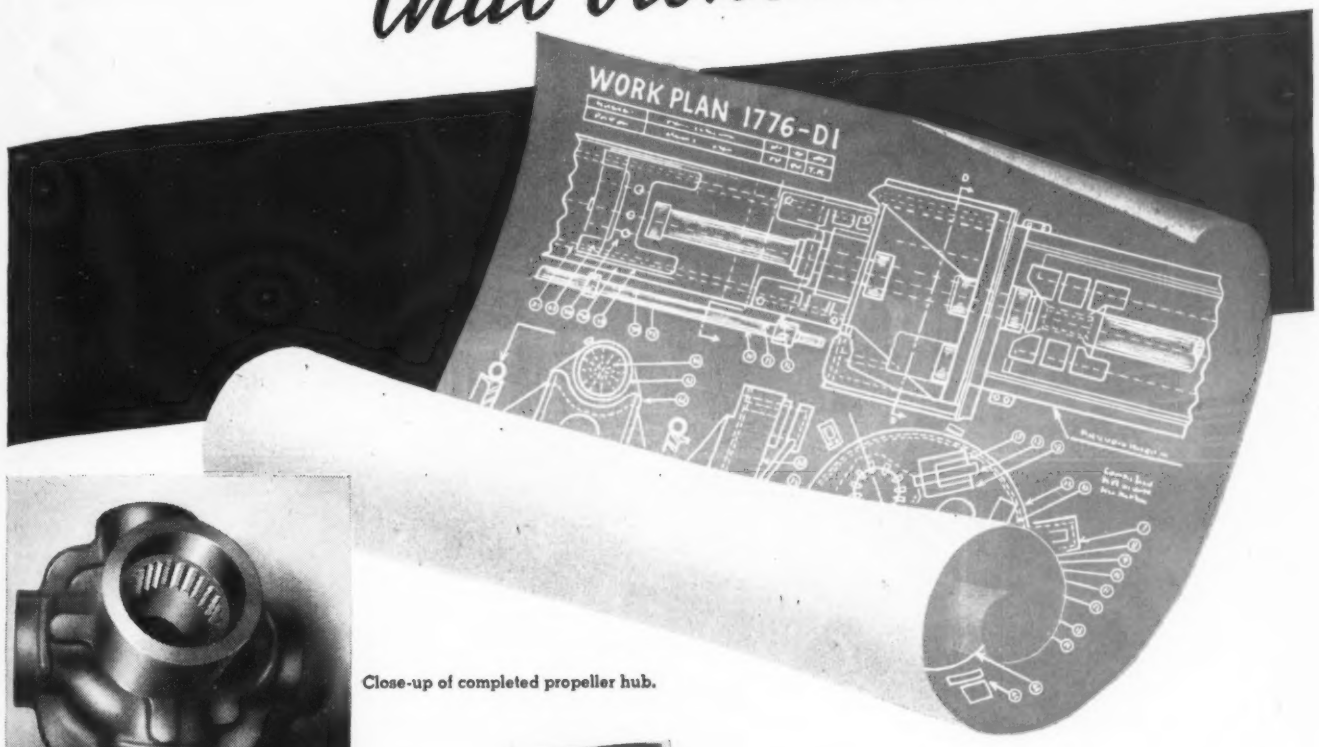
Your Problems...

whether it be opening or closing a tiny port, accurately tilting a steel mill furnace, or closely regulating the speed and movement of machinery . . . perhaps with a four-way valve such as the one shown above . . . we are sure HydrOILics has something to offer you in your plans for Tomorrow.

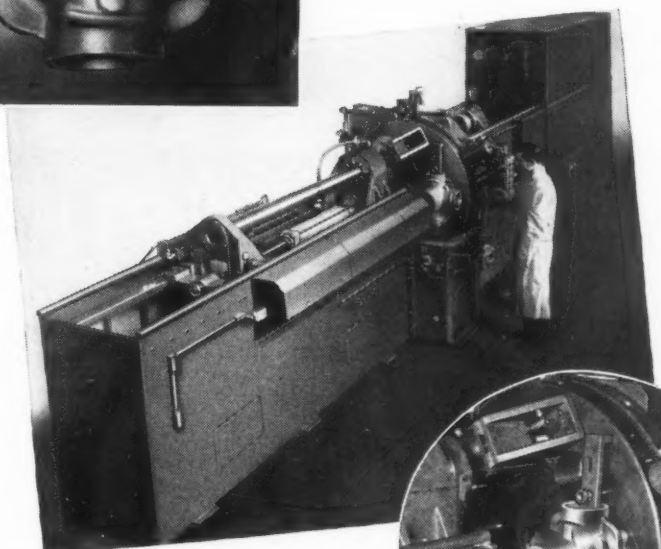
INDUSTRY'S NEW RIGHT HAND FOR POWER · SPEED · CONTROL · HydrOILics

DENISON
EQUIPMENT *in* APPLIED
HydrOILics

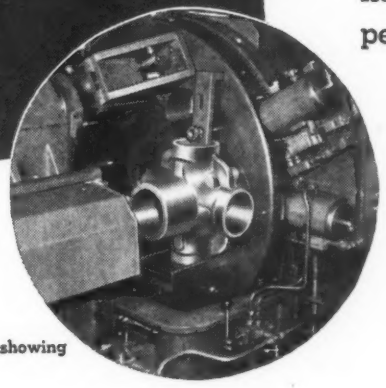
THE PIECE OF PAPER *that broke a bottleneck*



Close-up of completed propeller hub.



The Lapointe HP-150 which broaches 2 propeller hubs at one time.



Close-up of loading position showing automatic fixture.

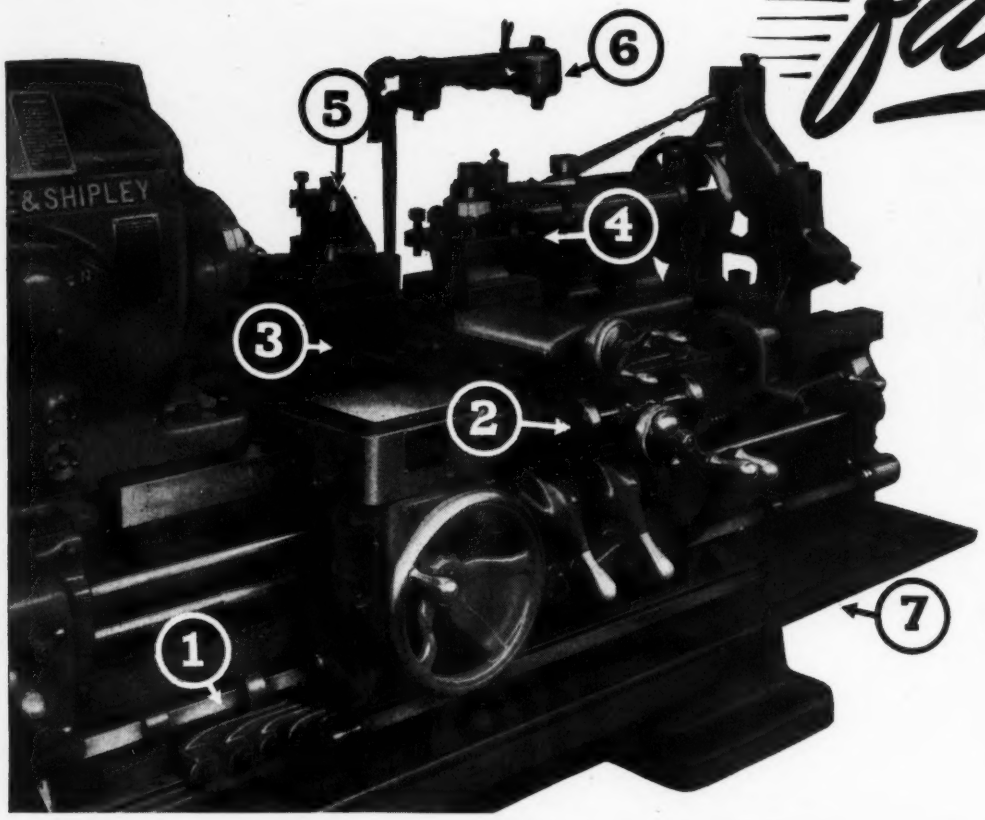
"Work plan — 1776-D1" was the appropriate nomenclature for the machine and broaches which today are making production figures unbelieveable a few short months ago. They are the chief bottleneck breakers in putting out spline propeller hubs for a new type aircraft propeller. Made of especially hard steel, these new propellers could be turned out in mass production with the precision tolerances desired only by broaching. Exact production figures are a secret but hub splining is no longer the bottleneck.

ARMY E NAVY

The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

Produce SMALL Lots *faster*



GOOD LATHES LATHES ONLY
SINCE 1892

ARMY E NAVY

Original Navy "E"
Awarded March 6, 1942

Why you save time with The Lodge & Shipley Manufacturing Lathe

Change over quickly and easily from one job to another.
Advantageous use of multiple tools and universal holders.
Transfer of diameter and length control from operator to lathe.

OUTSTANDING FEATURES

(1) Multiple Length stops (Telescopic Dog Type), automatically disengage longitudinal feeds.

(2) Multiple Diameter Stops, for both front and rear tools, can be quickly indexed for establishing diameters. Time wasting "cut and try" eliminated.

(3) Connected rear rest increases tooling possibilities. Adaptable to single or multiple tools.

(4) Four-way tool block on compound rest can be indexed for twelve equally spaced tool positions.

(5) High duty tool block in rear used for single tool can be supplemented or replaced with multiple holder.

(6) Coolant pump and piping.

(7) Chip pan.

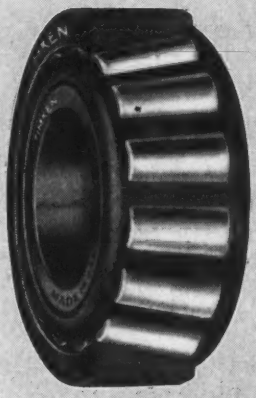
WRITE FOR PUBLICATION No. 482

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.

ENGINE TOOL ROOM AUTOMATIC OIL COUNTRY LATHES

THE product of this 12 Wire Stranding Machine is an important war material; it is largely used as field communication and assault wire by the Signal Corps. The performance of this machine—including speed, precision and economy—is given increased emphasis by the use of Timken Tapered Roller Bearings in the gear drive, cradle support and cradle roller or trunnion support positions.

Furthermore, lubrication is simpler; endurance is greater; maintenance is cut to the bone. For Timken Bearings meet every load requirement with a wide margin of safety—radial load, thrust load or both together in any combination; and hold moving parts in correct alignment constantly.



Thousands of Timken Bearing Equipped machines that today are concentrated on the job of winning the war, tomorrow will attack the peacetime job of reconstruction with equal efficiency. Make sure your new equipment contains Timken Bearings at every suitable position. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

HOLO-KROME

THE *BETTER* FASTENING METHOD

Completely Cold Forged

SOCKET SCREWS—made by a superior method, patented by Holo-Krome and used exclusively by Holo-Krome in the manufacture of these precision made FIBRO FORGED Socket Screws . . . The internal wrenching feature permits compact design in parts, machinery and machine tools—materials are used efficiently—weight is saved—all valuable space put to its full usefulness—assembly time reduced to a minimum . . . Daily applications prove Holo-Krome Socket Screws to be "the better fastening method".

SPECIFY "HOLO-KROME"

SAVE

WEIGHT—SPACE—TIME

GUARANTEED Unfailing PERFORMANCE

THE **HOLO-KROME** SCREW CORP. — SOCKET SCREW PRODUCTS — HARTFORD 10, CONN. U. S. A.

GULF CUT-AID

This revolutionary Gulf Cutting Oil is setting new standards of machine tool performance in hundreds of plants

Gulf Cut-Aid *consistently* shows better results in cutting aluminum and other nonferrous metals!

Here's a typical case:

Operation—machining forged aluminum fuse bodies for high explosive shells.

Result with Gulf Cut-Aid—increased production, longer tool life, and much better finish.

In addition to its superior performance in cutting nonferrous metals, Gulf Cut-Aid has another important function—it is an effective energizer for other cutting oils, regardless of type or viscosity. Blended in varying proportions depending upon the various requirements of the job, the use of Gulf Cut-Aid with other cutting oils makes possible higher production speeds and results in improved finish, longer tool life, or both.

Call in a Gulf Service Engineer today and let him show you how Gulf Cut-Aid and other Gulf quality cutting oils can help improve *your* machining practice.

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH, PA.

TOOLS ARE WEAPONS...
TREAT 'EM RIGHT

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation—Gulf Refining Company M
3800 Gulf Building, Pittsburgh (30), Pa.

Please send me, without obligation, a copy of the booklet, "Gulf Cutting Oils," which includes a 45-page Machining Guide.

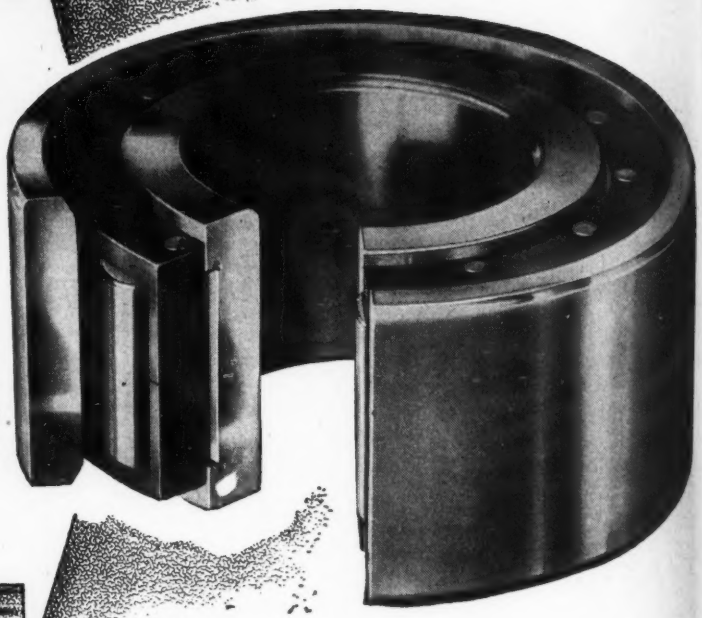
Company_____

Name_____

Title_____

Address_____

When Costs Count OVERLOADED BEARINGS MUST GO!

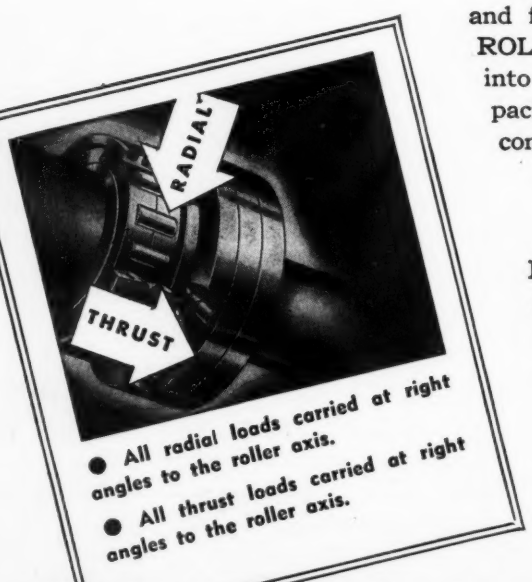


Switch to ROLLWAY'S RIGHT-ANGLE LOADING

before re-conversion starts . . .

The day is coming when fractions of a mill—not fractions of a minute—will win or lose orders. Buyers will worry about maintenance, not manpower . . . about saving money instead of metals.

You'll be sitting pretty if your machines offer the long life and freedom from trouble of ROLLWAY RIGHT-ANGLE ROLLER BEARINGS. Because Rollways split the load into *pure* radial and *pure* thrust! They increase load capacity . . . banish overloads . . . eliminate the oblique and composite forces which overreach elastic limits.



● All radial loads carried at right angles to the roller axis.

● All thrust loads carried at right angles to the roller axis.

PURE RADIAL OR PURE THRUST BEARINGS

There's no doubling up of load components with Rollway Bearings. Each load component is carried by a separate bearing assembly. That means thrust bearings that carry *pure* thrust, and radial bearings that carry *pure* radial—nothing else. Load capacity in given dimensional limits is greater. Unit loads per roller and bearing are lower. And the hazard of permanent set or quick failure due to overloads practically vanishes.

Don't wait until re-conversion problems overwhelm you. Find out now. Send drawings or detailed description for free bearing analysis and recommendation. S.A.E. or American Standard metric dimensions and tolerances are available for most applications, assuring quick supply and low cost.

ROLLWAY BEARING COMPANY, INC., SYRACUSE, NEW YORK

BUILDING HEAVY-DUTY BEARINGS SINCE 1908 **BEARINGS**

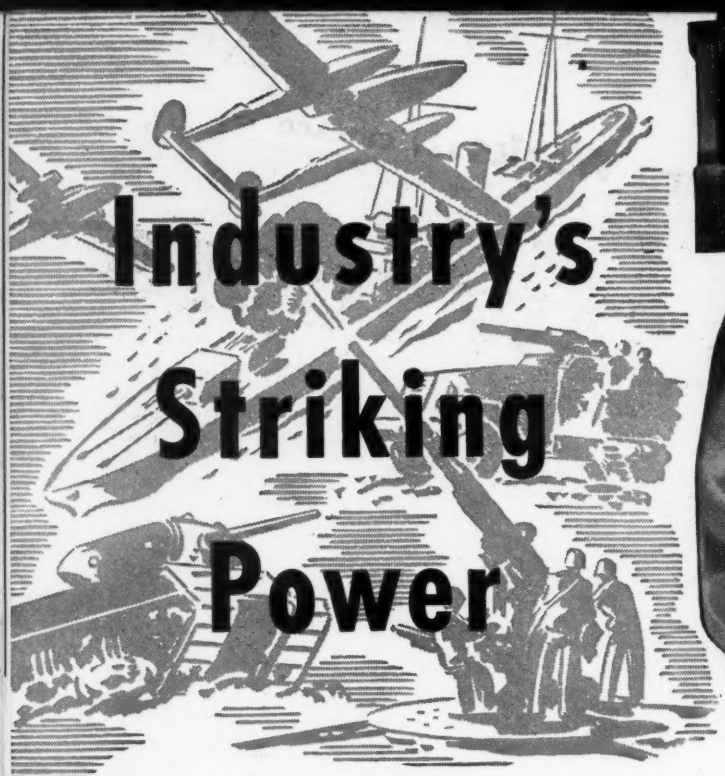
At Reliance Pattern Works... CHICAGO
• Perfect, satin-smooth surfaces are produced quickly and easily on metal-faced pattern beds with Model "SL" Disc Sander!
• Light, compact, powerful ¼ in. SKILDRILL is ideal for fast, true drilling even in closest quarters on wood and metals.
• Model "B" Belt Sander (with powerful vacuum dust pick-up) finishes Kirksite-faced die quickly and accurately.
SKILSAW

• In making patterns and dies for vital War Production, Reliance sets itself two tough goals: *speed and perfection!* And Reliance achieves those goals with SKILSAW TOOLS! They're designed for the lightness and perfect balance that mean easy handling and accurate work. They're built to rigid standards that insure constant precision. And SKILSAW TOOLS are *extra* powered for *extra* output on every job!

Ask now for a demonstration of SKILSAW TOOLS in your own plant. See for yourself just how these SKILSAW TOOLS *produce a craftsman's results at Wartime speed.* Phone your distributor.

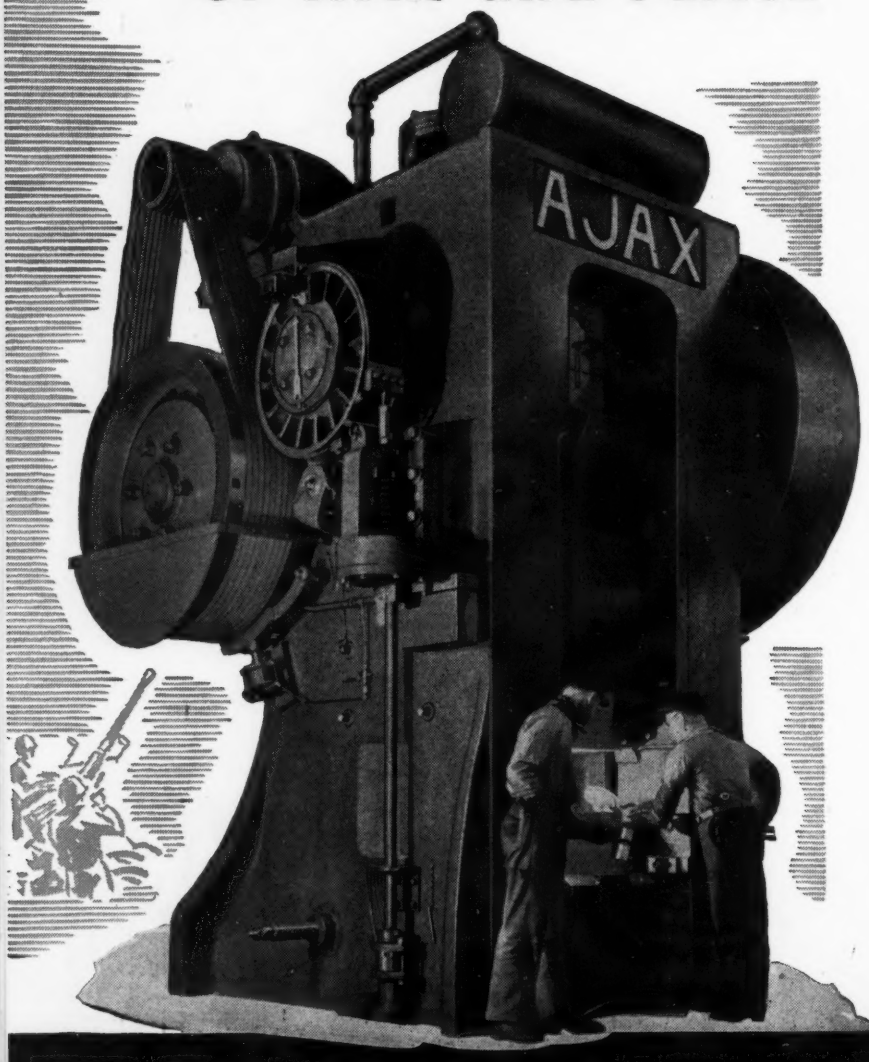
SKILSAW, INC.
5039 Elston Ave., Chicago 30, Ill.
Sales and Service Branches in All Principal Cities

SKILSAW PORTABLE ELECTRIC TOOLS
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★



Industry's Striking Power

for Forging the Products of WAR and PEACE



Today, in forge shops all over the country AJAX Forging Machines and Forging Presses are performing a vital role in the high speed production of material for war, such as parts for ships, guns, tanks, airplanes, bombs and shells—adding their full share to industry's all out effort toward speeding victory. And when that goal has been attained and the requirements for war are curtailed, with merely changing of the dies these same machines and presses will produce, economically at high production rates, accurately forged parts for automobiles, refrigerators, farm implements, railroad cars, and many, many more products to immediately meet the requirements of a new and greater peacetime economy.

Write for Descriptive Bulletins.

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND, OHIO

621 MARQUETTE BUILDING • CHICAGO, ILLINOIS

Many of today's Machine Shops are going to need their "faces lifted" for tomorrow's jobs

NOT only because their machines have grown prematurely old due to the strenuous years of war work but also because these shops will have to cope with new materials—new methods and techniques.

Rejuvenation of some of these machines may be effected by re-building—but this will only partially solve the problem—most of the shops will need the newly developed machines so as to keep in step with the coming competitive future era.

In 95 years of PRECISIONEERING on fine machine tools, Sellers engineers have encountered a thousand-and-one problems in design—problems which involve ways and means of doing the job in question better, faster, cheaper. This vast fund of knowledge is available now to those industrialists who realize that only the *modern* plant can hope to meet the challenge of post-war competition . . . Glad to consult with your engineers on this highly important subject . . . Wm. Sellers & Company, 1612 Hamilton St., Philadelphia, U. S. A.

SELLERS PRECISIONEERING SINCE 1848

Bodine SET-UPS MAKE PRODUCTION Sing..

If you are not completely satisfied with your production equipment for small parts . . . send for the Bodine Bulletin. It tells a story of simplified set-ups, fool-proof operation, accuracy and SPEED . . . with facts, figures and photos you will want to digest.

DRILLING, MILLING, TAPPING, SCREW INSERTING

The accompanying photograph shows a Bodine #48-30 set-up for drilling and tapping holes for ⅛" pipe threads in forged steel spiders for universal joints.

One hole is positioned at an angle to another as indicated by the angular position of the horizontal drilling and tapping spindles.

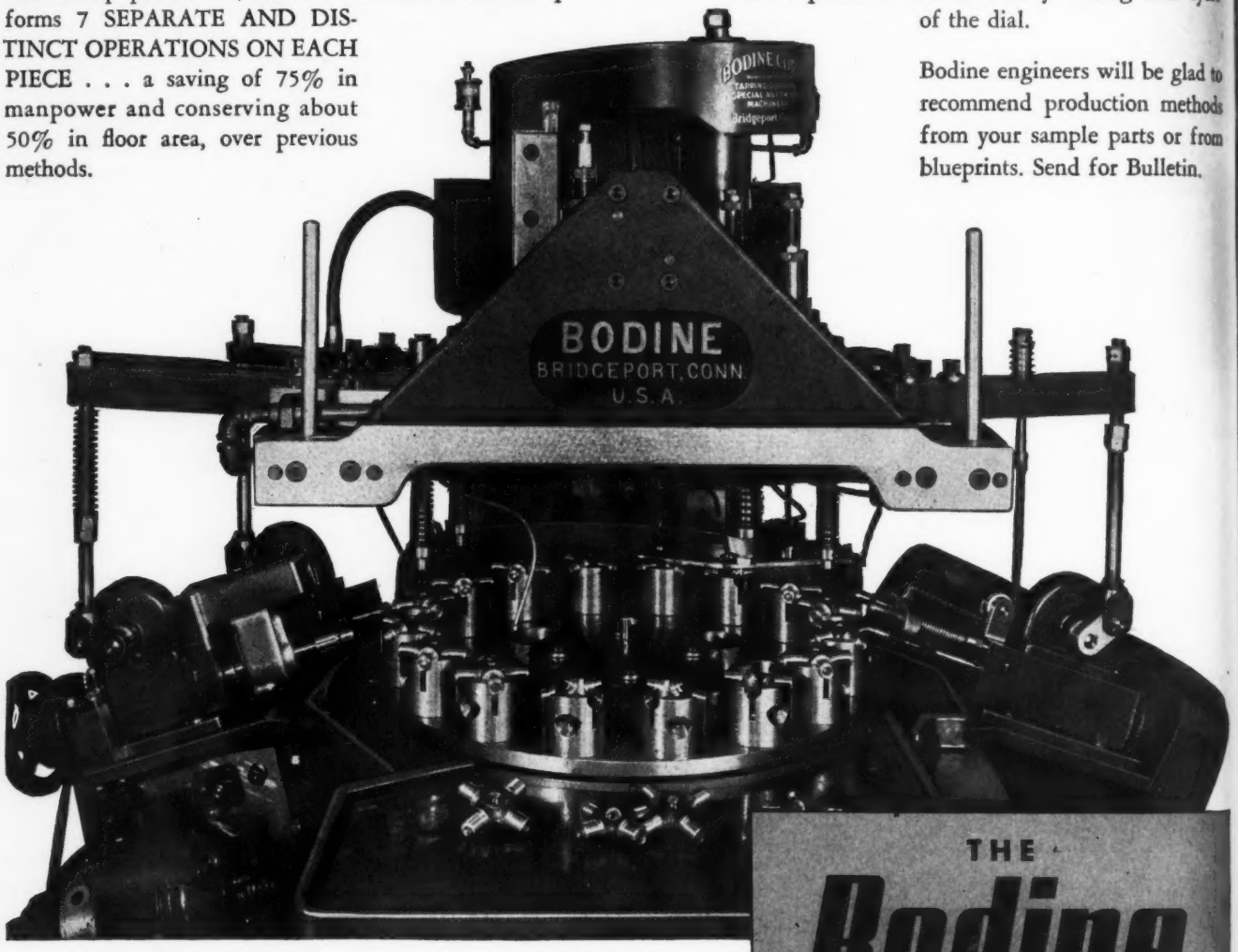
This set-up produces 7 PIECES PER MINUTE and performs 7 SEPARATE AND DISTINCT OPERATIONS ON EACH PIECE . . . a saving of 75% in manpower and conserving about 50% in floor area, over previous methods.

Parts are hand fed to fixtures on the horizontal dial which automatically indexes to seven spindles. Ejection is manual in this instance. With 6 standard Bodine sizes, carrying from 4 to 8 spindles, drilling and tapping up to ½" dia. and 3½" in depth, the set-up possibilities are almost endless.

All Bodine machines are extremely compact, the smaller requiring but 54"x60" floor space . . . the larger, 90"x96". Electrically operated devices protect the work and tools from damage and insure safety to operators.

Bodine design permits location of spindles to operate vertically, horizontally, at an angle or from inverse positions —or from all positions simultaneously during one cycle of the dial.

Bodine engineers will be glad to recommend production methods from your sample parts or from blueprints. Send for Bulletin.



For saving manpower . . . for quick training of operators, especially women, Bodine machines are most valuable. Investigate now for immediate needs . . . for post-war reconstructed production lines.

THE Bodine CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

THE STORY OF STEEL

FROM FURNACE TO FIRING LINE IS TOLD BY "FACTS-IN-FIGURES"

In a steel mill, Control by Count begins with the ore-cars which are tallied by a Veeder-Root Magnetic Counter, as they unload on top of the furnaces. Ingots are counted as they enter the blooming mill and again counters are used as the steel enters the rolls where space between rolls must be accurately maintained. This space is visualized for the operator by motorized counters that read in thousandths of an inch, and help him to control steel-thickness. Here, too, the white-hot ingots are counted by *their* own light which actuates a sensitive electric tube.

Veeder-Root Counting Devices are also used to measure the number of feet of production of structural shapes . . . the length of any defects in finished bars . . . the number of "wraps" of steel on reels in reversing mills . . . the length in feet of total sheet produced.

Veeder-Root Counters are used for many different jobs in tube, pipe, and wire mills . . . in handling and transporting . . . to control input of electric current into mill motors, the amount of coal automatically stoked, or the amount of gas consumed. Finally, they do many jobs in the front office, on phones, typewriters, business machines . . . even helping in payroll and personnel work. Then when steel is made into tools of war, the Armed Forces take over, and Control by Count continues right up to the battle lines.

Every inch of the way, steel counts heavily on these "fighting figures" supplied by Veeder-Root Devices. And if your work is of frontline importance, then *you* can count on Veeder-Root, too.

VEEDER-ROOT

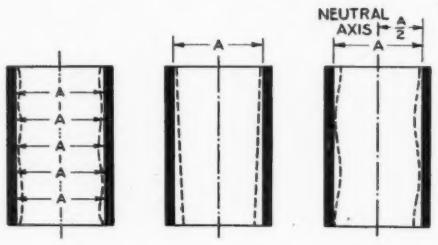
INCORPORATED

Hartford, Connecticut, U. S. A.

MICROMATIC offers you
THE HYDROHONER

**[Accuracy, Uniform Size
Stock Removal
Controlled Surface Finish]**

THE HONING PROCESS



Diametric Roundness

GENERATES Diametric Straightness

Axial Straightness

CORRECTS Taper

Out-of-roundness

Axial Distortion

Micromatic Hydrohoner—
With Automatic Microdial . . .
Precision Hones to uniform size.
Machine stops when correct size is reached.

Micromatic Honing is a process for finish machining cylindrical surfaces—internal or external by means of controlled abrasion.

Abrasive sticks positively expanded by the hone, are rotated in contact with the work and are given one or more reciprocating motions at the same time—all actuated under extremely low speeds and pressures.

Stock is removed at rates up to .001″ per minute on diameter—to more than 1 cubic inch per minute in volume on hard, forged steel.

Roundness is generated—out-of-roundness is corrected within tolerances as low as .0001″ in many applications. Taper is corrected and diametric and axial straightness is generated by stones long enough to overcome deformity.

Uniform size is generated in high production to tolerances as low as .0005″.

Microhoned surface finish may be controlled to any degree—from matte (grey) to mirror (black).

MICRO MATIC

Micromatic
HONE CORPORATION
Detroit 4, Michigan

MAKERS OF HONING MACHINE TOOLS

a New VERTICAL HYDROHONER

A High Production Vertical Type Hydrohoner

Diameter of Work . . . ¼" to 2".

Spline Driven Head Reciprocating Stroke . . . 15"—30"—40" (standard).

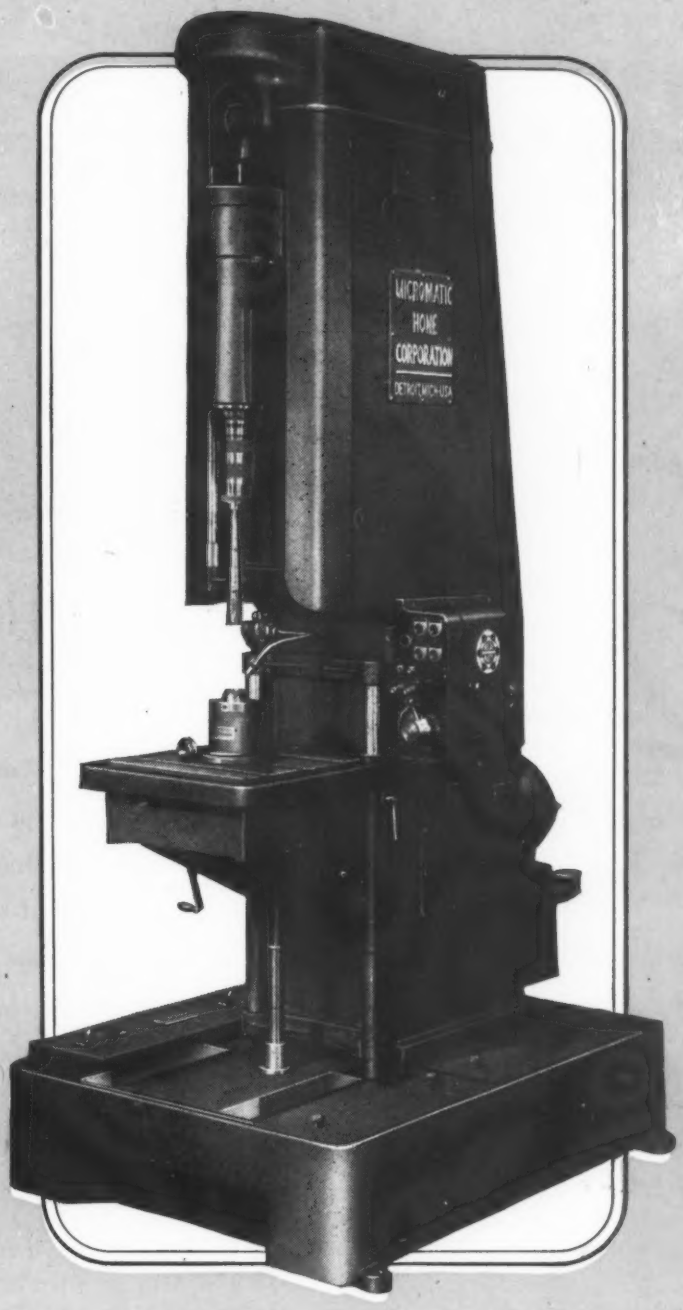
Spindle Oscillating Stroke . . . 0 to 1" maximum.

Centralized Hydraulic Operating Control. Panel provides easy operation—fast production. Hydraulic tool expansion assures uniform pressure and cutting rates for fast precision work.

Other features are—hydraulic timer—full ventilated hydraulic oil tank of 60-gallon capacity mounted in base.

Also available with 3-speed transmission, rising screw table, electric timer, special coolant filter, and special coolant refrigeration.

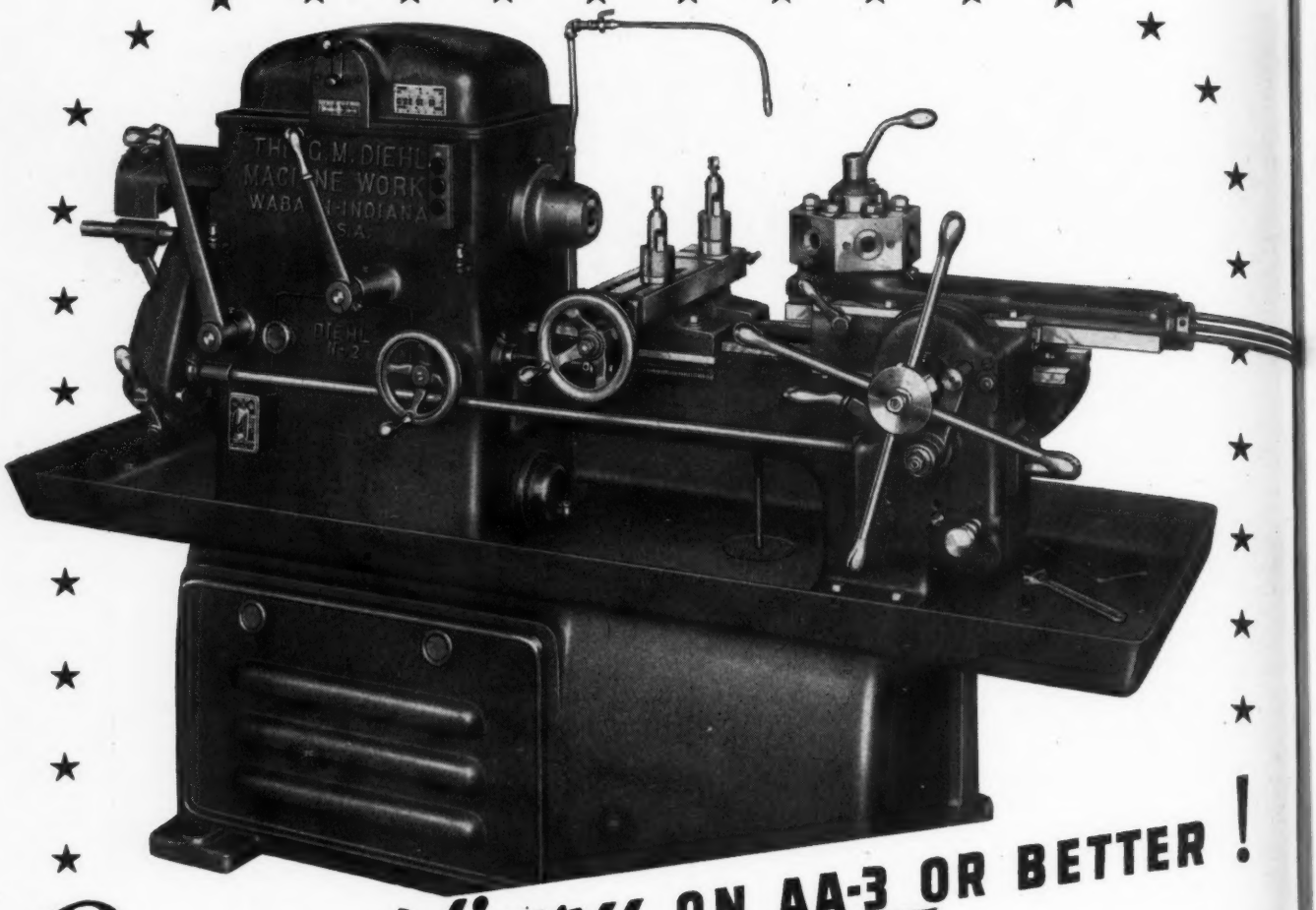
Available for normal prompt delivery.



MICRO MATIC

Micromatic HONE CORPORATION

DETROIT 4, MICHIGAN



2 weeks delivery ON AA-3 OR BETTER !

Prompt delivery of Diehl No. 2 Turret Lathes can be made on ratings of AA-3 or better. This means prompt replacement of worn out lathes, or production lines can be enlarged without delay. For the Diehl No. 2 Lathe works alongside other No. 2 lathes of standard make, using same tooling, including collets. Embodying the most advanced developments, the Diehl Lathe is unsurpassed for sustained, high speed, precision performance. For replacement or additions, Diehl is a natural.

Automatic chuck capacity (round)	**1″**
Swing-over cross slide	**6″**
Swing-over bed	**14″**
Six speeds	**forward and reverse.**

WRITE FOR COMPLETE SPECIFICATIONS AND ILLUSTRATED BROCHURE

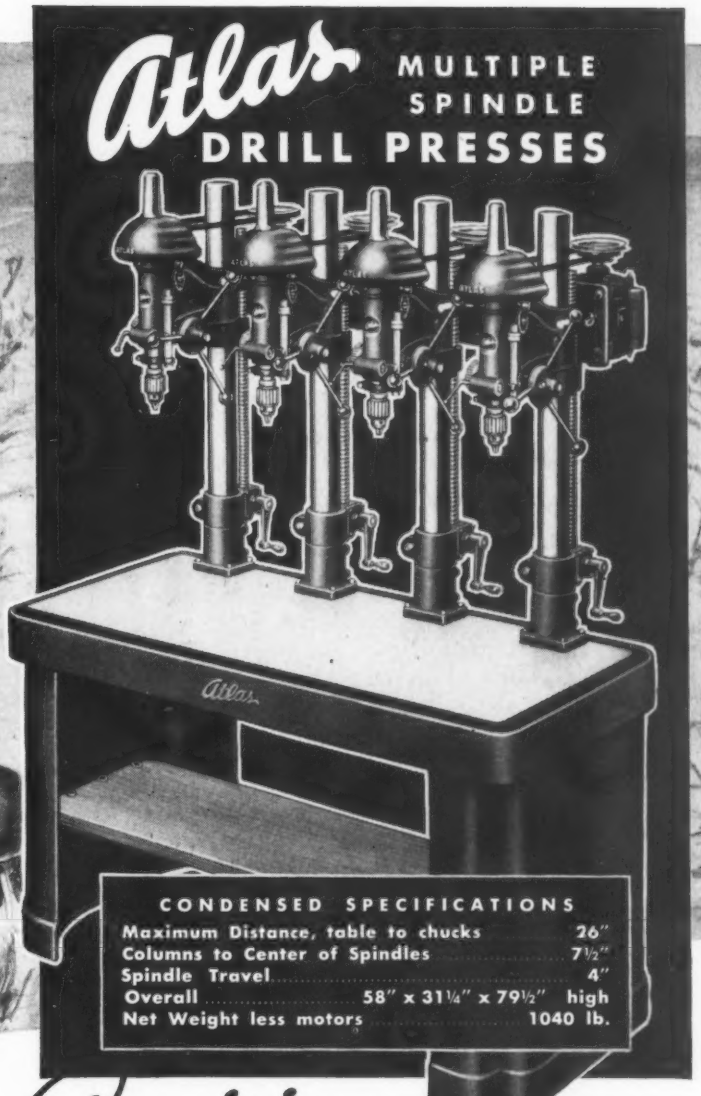
The G. M. **DIEHL** *Machine Works, Inc.*

WABASH, INDIANA

Where precision craftmanship is honored

KEEP 'EM FIRING • BUY WAR BONDS

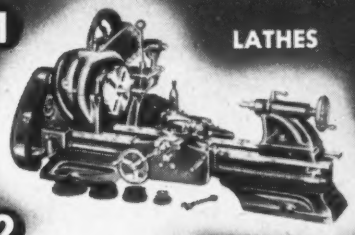
Atlas MULTIPLE SPINDLE DRILL PRESSES



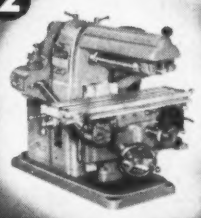
CONDENSED SPECIFICATIONS	
Maximum Distance, table to chucks	26"
Columns to Center of Spindles	7½"
Spindle Travel	4"
Overall	58" x 31¼" x 79½" high
Net Weight less motors	1040 lb.

Atlas 4 TOOL TEAM FOR SMALL-PARTS MACHINING

1 LATHES



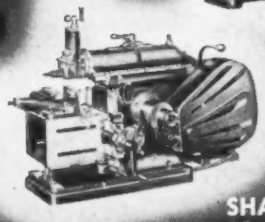
2 MILLING MACHINES



3

DRILL PRESSES

4



SHAPERS

Precision STOPS THE TIGER TANKS!

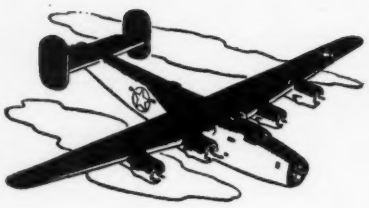
The Nazis counted heavily on their ponderous Tiger tanks but tank destroyers stopped them cold. Again the vision of our Army and civilian designing engineers — plus the ability of American industry to get into precision production in a hurry scored another decisive ordnance victory!

Atlas machine tools contribute importantly to this precision in thousands of war plants . . . and help to maintain it in the mobile machine shops of our armed forces. The Multiple Spindle Drill Press, for example, has drilled and tapped literally billions of holes for Victory. It's a favorite for stamina, accuracy, and speed on series drilling and tapping operations. Its low cost and high production capacity have cut costs for hundreds of plants.

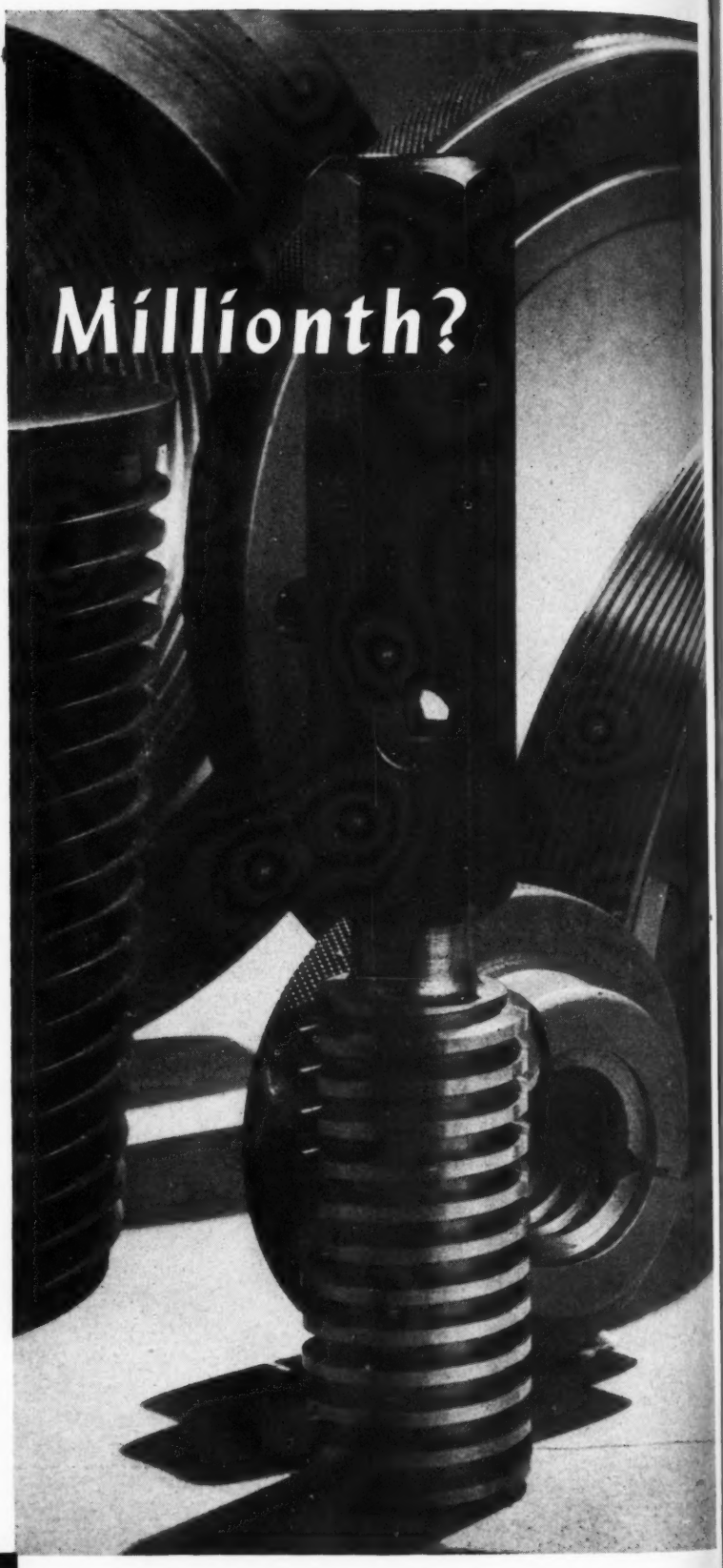
Atlas precision and low cost can help you win peacetime business, just as it is helping win wartime battles. Keep Atlas in mind for re-conversion . . . send for Atlas catalogs now for quick reference when you need tools.

ATLAS PRESS COMPANY

253 N. PITCHER STREET • KALAMAZOO 13D, MICHIGAN



A Mile in a Millionth?



High-flying bombardiers would never hit Axis objectives without gaging accuracy to the nth degree. If sights are off a "millionth" — bombs will "miss by a mile."

Victory-minded manufacturers, shooting at peace-pushing production targets, must also gage accuracy. Machined parts necessitate a "direct hit" on their initial trip to final assembly, assuring our fighting men superior weapons.

Axelson Gages, product of specialized experience for fifty years, are maintaining precision production in war plants everywhere. Thread gages, plug gages, special angle gages, gaging fixtures, jigs, hobs, reamers, taps and milling cutters — are all tailored to fit individual specifications.

Line-up your production targets with Axelson *accurate* Gages!

AXELSON
MANUFACTURING COMPANY
6160 SO. BOYLE AVE. (Box 98, Vernon Sta.)
LOS ANGELES 11, CALIFORNIA
• 50 Church Street, New York •
204 Munsey Building, Washington, D. C.
• 3844 Walsh Street, St. Louis •

ARMY E NAVY
THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

DoALL GRINDER. Model G-1—The new hydraulic surface grinder gives up to .0001" tolerance. Designed for all precision toolroom work.

DoALL MAGNETIC CHUCK—Holds all work absolutely rigid. Mount on any grinder table. Wired for both 110 and 220 volt D. C.

DoALL SELECTRON—Provides DC current to chuck. Demagnetizes chuck in 15 seconds. Varies magnetic power to grind heavy, thin or fragile work.

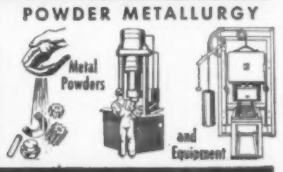
DoALL *Presents*

COMPLETE EQUIPMENT *for* BETTER GRINDING

Establish a reputation for the finest precision grinding with these modern grinding necessities.

DoALL Products listed on this page, used in conjunction with any good surface grinder give a grinding service second to none for regular production or for tool room operations requiring grinding to very close tolerances.

Send for the DoALL book illustrating all these Necessities.



DoALL

Write for Literature on above Products to

CONTINENTAL MACHINES, INC. 1312 S. Washington Ave., Minneapolis 4, Minn.

Why CLARY MULTIPLIER INCREASED TAPPING PRODUCTION *540%*

CASE HISTORY No. 4

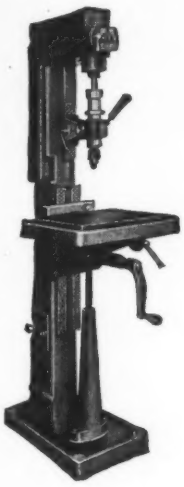
The fourth of a series of actual case histories showing how Bakewell Precision Tapping Machines save invaluable time and critical materials in war production.

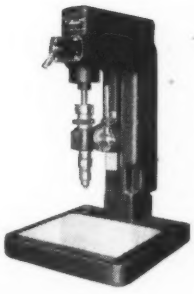
FIRM: Clary Multiplier Corporation, Los Angeles
TAPPING MACHINE: Bakewell bench model No. 0
PIECE TAPPED: Anchor Nut
MATERIAL: X1112 steel
CLASS FIT: 3
SIZE OF TAP: 10-32
NO. HOLES TAPPED PER HOUR WITH BAKEWELL: 2000
NO. HOLES TAPPED PER HOUR BEFORE USING BAKEWELL: 312
REMARKS: We have a battery of 3 Bakewell No 0 models, all tapping 24 hours a day. Sizes range from 10-32 to ¼-28; the latter holes are tapped at the rate of 1000 an hour. All our operators are girls. We use Witherow B40 cutting oil.

BAKEWELL
Manufacturing Co.
2009 SANTA FE AVE., 21 • LOS ANGELES, CALIF.

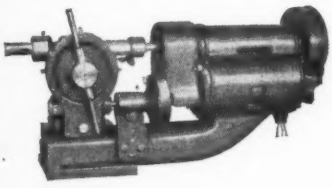
A HIGHLY DEVELOPED LINE...

Avey





MA 8—Eight speeds. 1200 to 12,000 R.P.M. Small work up to 3/8". Built-in motor. Bench and column types. 1 to 6 spindles.



Type B—No. 1, No. 2, No. 3 sizes. Hand feed drilling units. Hand feed tapping units Power feed drilling units.

ONLY years of steady development can evolve the drilling equipment that is found in the Avey Line of Sensitive Drilling Machines.

The advances required in machining methods caused by the demands for greater output, necessitated more efficient drilling equipment. Avey Drilling Machines have steadily led the field.

Avey High Speed Sensitive Drilling Machines are built-in types and sizes to cope with varied needs. They are designed in capacities from the smallest drill gauge size to approximately 1¼ inches.

Being ball bearing throughout, they rate the highest speeds without vibration. This feature insures maintained accuracy.

The Avey Catalog details the line of Avey Drilling Machines and Drilling Machine Accessories.

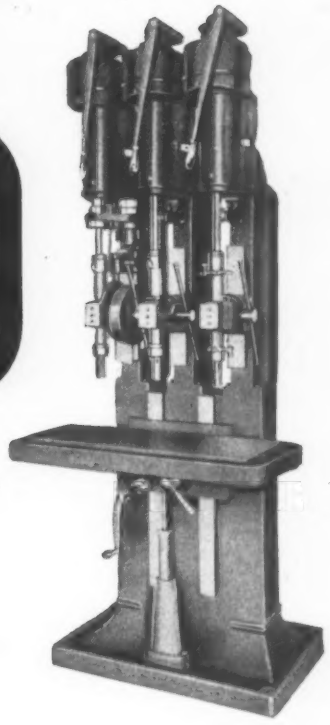
Avey Engineers will come to your aid in solving new and different drilling problems.

●

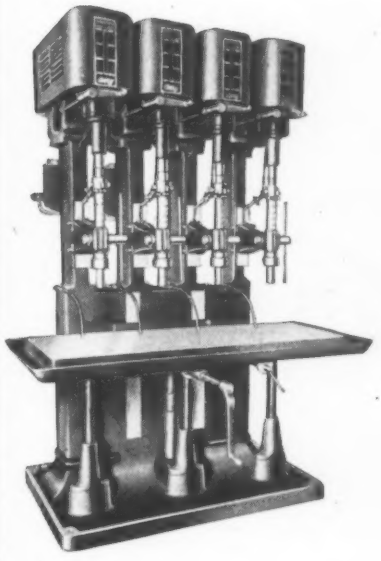
Individual Motors for each Spindle.

Single and Multiple Spindles.

AVEY
DRILLING MACHINE CO.
CINCINNATI · OHIO



MA 6—Six speeds. No. 2 and No. 3 sizes. Built-in motors.



Belted quick speed change machine. No. 2 size. Four speeds. Standard frame motors.

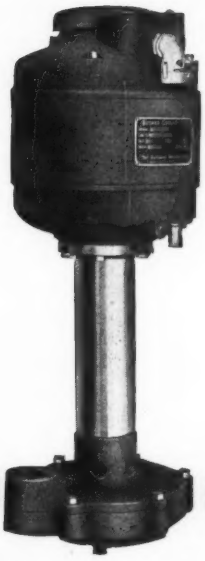
Avey DRILLING MACHINES

CINCINNATI · OHIO

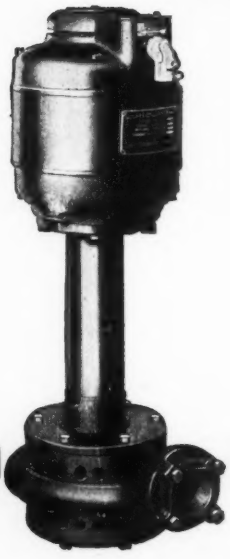
DEPENDABLE

. . . **because** with the Gusher Coolant Pump, grit and fine chips can't wear or clog the mechanism, or interrupt the steady flow of coolant needed on precision war jobs. Ruthman impeller housing, built without metal-to-metal contacts, permits grit and fine chips (as well as non-lubricating liquids such as lapping, honing and grinding compounds) to pass through freely.

. . . **because** unique features of Ruthman design assure smooth, trouble-free performance even under the multiple cuts, high speeds and continuous operation demanded by war production—such features as full ball-bearing construction, simplified design that eliminates all packing nuts, foot and relief valves.



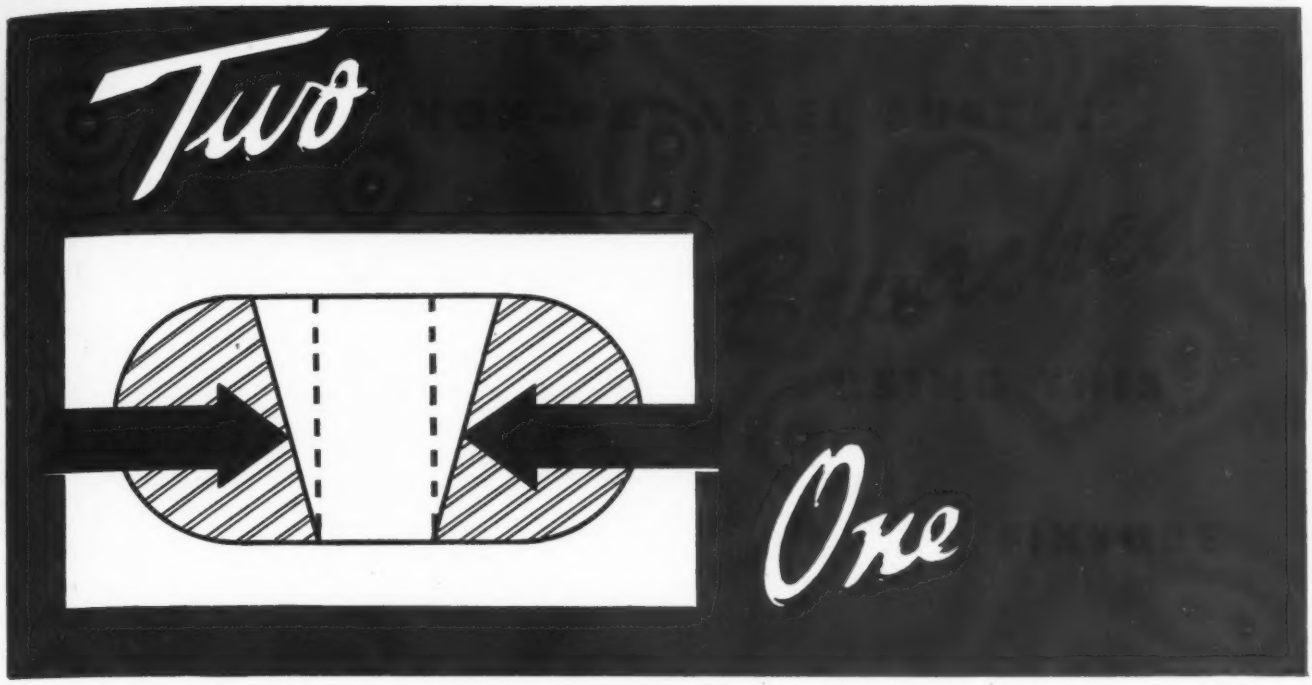
. . . **because** you can open up a Gusher Coolant Pump or throttle it down to supply—instantly—just the right volume of coolant for maximum cutting and cooling efficiency, from a trickle to its maximum capacity.



★ **Send for new 126-page "Catalog M" illustrating the complete Ruthman line of coolant pumps. They're**

THE COOLANT *Heart* FOR A GOOD MACHINE

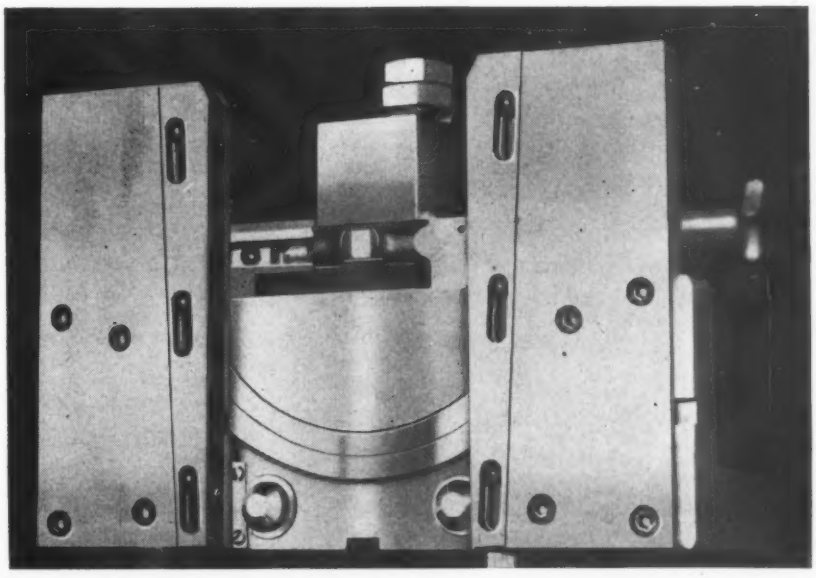
THE RUTHMAN MACHINERY CO.
1809-1823 READING ROAD
CINCINNATI OHIO



ANOTHER EXAMPLE OF HOW DETROIT BROACH ENGINEERS DEVELOP NEW APPLICATIONS IN BROACHING

The fixture shown here was designed and built by Detroit Broach Company to provide the necessary rigidity and at the same time provide a means for turning the part several degrees. Thus it is possible to broach non-parallel surfaces in one stroke of the ram.

It is work of this kind that has made Detroit Broach Company famous throughout the country for doing things with broaches that others have called impossible. Broaching can increase speed . . . improve accuracy . . . in many manufacturing operations. Broaching will solve many of your production problems. Write Detroit Broach Company today.



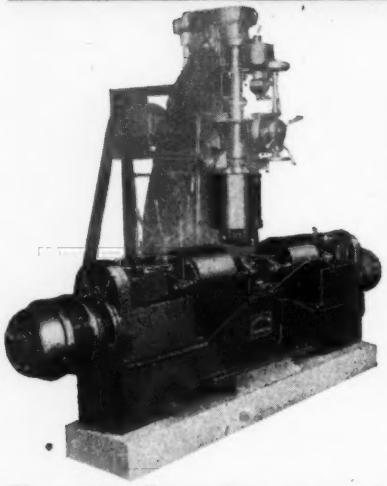
ARMY E NAVY

DETROIT BROACH COMPANY

20201 SHERWOOD AVENUE • DETROIT, MICHIGAN

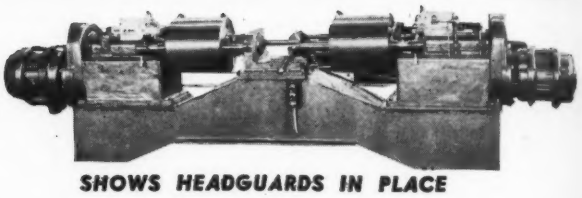
9308 SANTA MONICA BLVD. • BEVERLY HILLS, CALIFORNIA

ADAPTABILITY.. HOEFER MULTIPLE SPINDLE HEADS OFFER MANY PRODUCTION COMBINATIONS FOR INCREASING OUTPUT



EXAMPLE: Showing the possibilities of making a three-way high production machine using two units mounted on a base in connection with a standard heavy duty driller. The central electrical control and the regular power feed lever on the driller automatically start the feed of both units, which go through their required cycle and stop at return position. This unit drills 26 holes in three different planes in the time previously taken to drill the longest hole of the 26.

These units will more than repay your investment in the quality of work produced and in uninterrupted service. No matter what your job is we can furnish the head to meet your production need. Let one of our experienced engineers confer with you.



SHOWS HEADGUARDS IN PLACE

GUARDS REMOVED

EXAMPLE 2: Two way machine consisting of 3 and 5 h.p. units driving 8 and 12 spindle universally adjustable heads. The fixture is mounted on center of machine for drilling both ends of compressor simultaneously. Machine has central electrical and central hydraulic control.

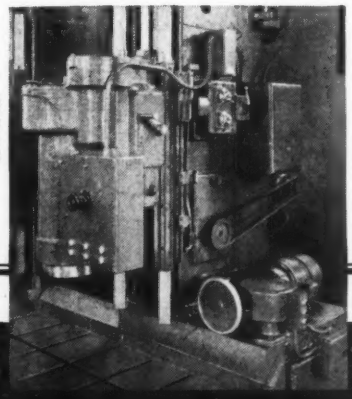
Hoefer's Whole Business is Holes . . . . HOEFER MFG. CO. Freeport, Ill.

Bores Connecting Rods of Many Lengths

Both ends of large Diesel engine connecting rods are trepanned and bored by this special MOLINE No. HF144, two-column boring machine. Holes up to 12 inches in diameter on 20 to 60-inch centers can be handled because the right hand column is mounted on a heavy slide which is traversed by electric motor on a horizontal V-guide and flat way. The column is clamped in position on the ways or moved for close adjustment by means of handwheels. A hardened and ground plate on each spindle head permits the use of spacing rods for adjustment of centers.

Electrically controlled, hydraulic feed moves the spindle heads on vertical, double V-guides at rates from .125 to .9 inches per minute. Any spindle speed from 5.66 to 236 R.P.M. can be obtained through quick change gears and 3 to 1 speed range spindle drive motors.

If you have a problem in drilling, boring, honing, milling, tapping or reaming, submit it to MOLINE.

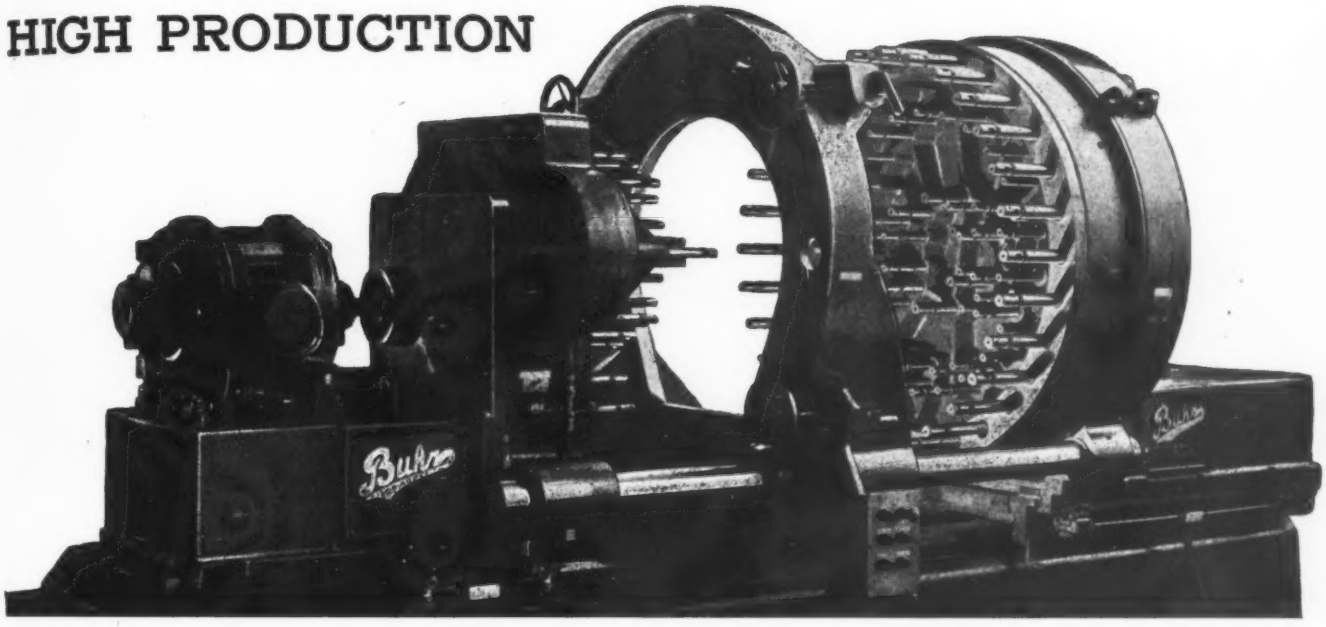


Right: Close-up of spindle head showing spindle speed rheostat and push buttons for motor control.

DESIGNERS and BUILDERS of SPECIAL MACHINERY since 1901. "HOLE HOG" Drilling, Boring, Honing and Tapping Machines.

VETERANS OF OTHER WARS
STILL FIGHT!

ANOTHER CONVERSION
FOR
HIGH PRODUCTION



Buhr ENGINEERS HAVE PUT VETERAN MACHINES OF OTHER WARS INTO INCREASED PRODUCTION

• LET BUHR HELP YOU INCREASE PRODUCTION SCHEDULES

BUHR MACHINE TOOL CO.

Specialists in Multiple-Spindle Drilling, Boring, Reaming and Tapping Equipment

ANN ARBOR **MICHIGAN**

WARTIME, PEACETIME—KEEP 'EM CUTTING *The Wells Way!*

WELLS No. 8

Wells SAWS
THE SIGN OF SERVICE

THE SAW WITH THOUSANDS OF FRIENDS IN INDUSTRY!

A fast and accurate metal cut-off saw able to handle most all types of metals in various shapes and forms as applied to industry. It wanted a versatile, simple unit for odd jobs or production work. The Wells No. 8 was the answer — and that is why so many plants, large and small, have Wells Saws.

Today's war production program and tomorrow's peace-time competition will emphasize the advantages Wells Engineers have built into their products. If you have metal cutting problems look for the answer in a Wells. Call your distributor or write direct.

Wells Has Established Leadership

SPECIFICATIONS

WELLS No. 8

Capacity: Rectangle.....8" x 16"
(spec. bowed guides)... 5" x 24"
Rounds.....8" dia.
Speeds: ft. per min. 60, 90, 130
Motor.....Specifications optional

WELLS No. 5

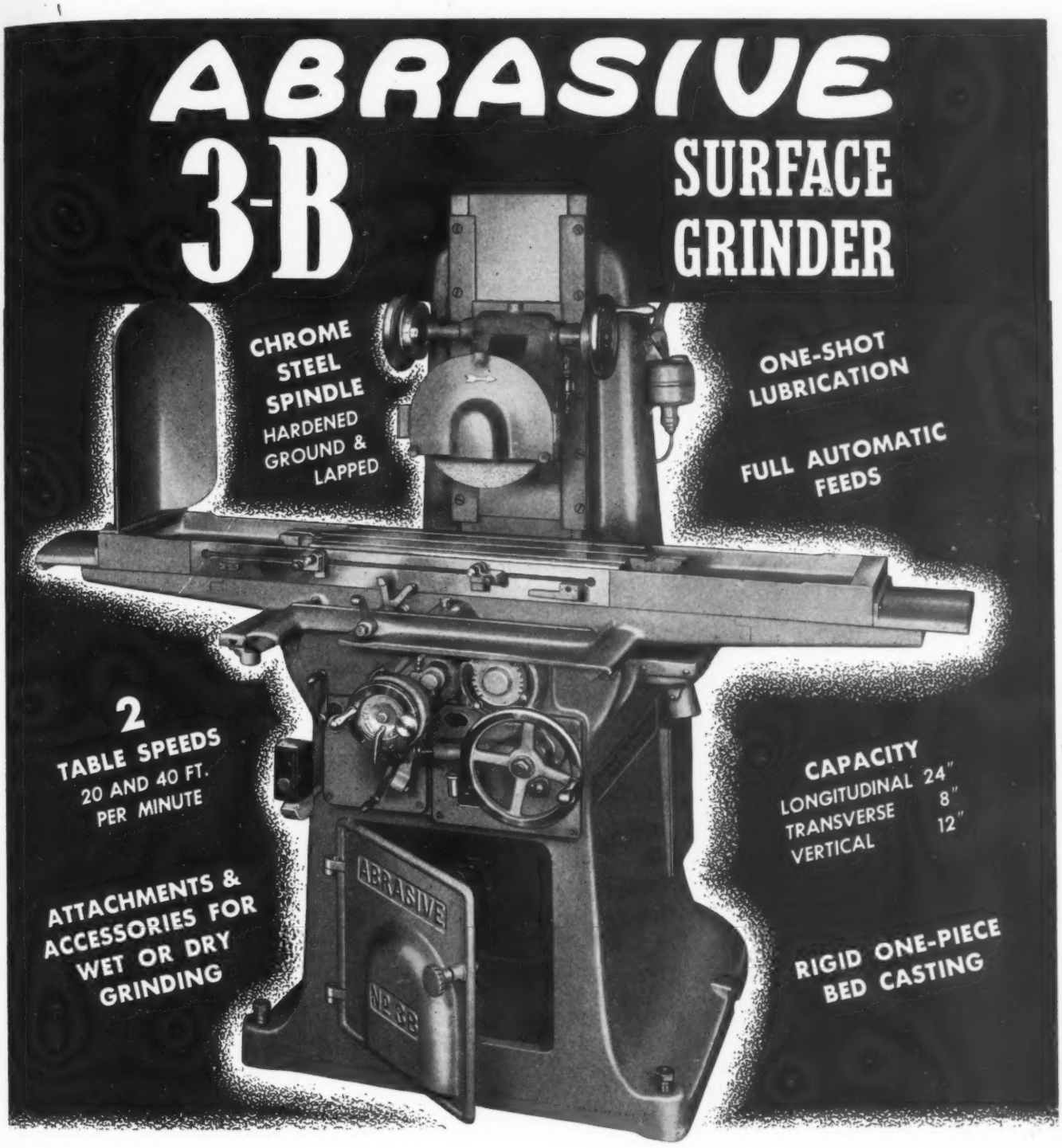
Capacity: Rectangle... 5" x 10"
(spec bowed guides)
Rounds .....5" dia.
Speeds: ft. per min. 60, 90, 130
Motor: .... Specifications optional

WELLS MANUFACTURING CORPORATION

METAL CUTTING BAND SAWS

404 SOUTH GRANT • THREE RIVERS, MICHIGAN

ABRASIVE 3-B SURFACE GRINDER



TODAY this highly accurate and dependable surface grinding machine is serving the production needs in many war plants.

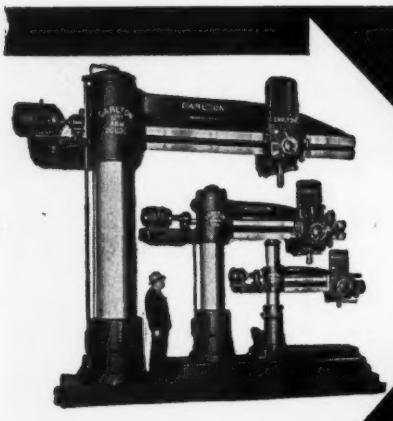
TOMORROW the accuracy, reliability and production capacity of the 3B grinder will be important factors in peacetime competition.

ABRASIVE

ACCURACY BOOSTS PRODUCTION

ABRASIVE MACHINE TOOL CO • EAST PROVIDENCE 14, R. I. • *Dealers in Principal Cities*

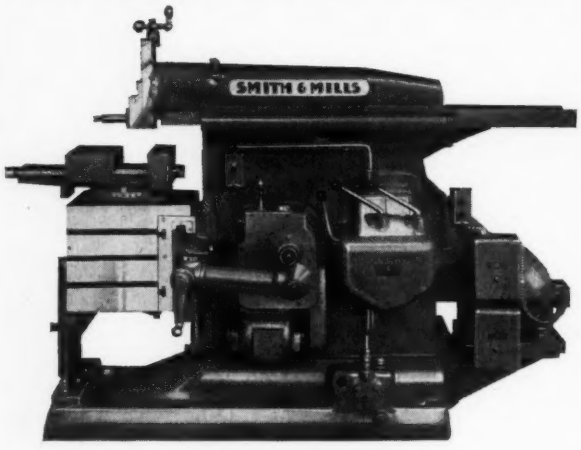
CARLTON RADIALS



» Carlton Radial Drilling Machines are in use in many of the United States Naval Yards throughout the country. They are also being used by the regular commercial ship builders and by sub-contractors such as—steel mills, the large electrical companies, and others supplying materials for the construction of ships.

THE CARLTON MACHINE TOOL CO., Cincinnati, O.

DESIGNED FOR THE FUTURE TO PRODUCE FOR THE PRESENT



A Smith & Mills Shaper that gives you tool room accuracy on production jobs at the speed and ease of control you demand in the shop. Write for catalogue and specifications on all sizes from 12" to 32" stroke.

THE SMITH & MILLS CO.
CINCINNATI, OHIO

HAMILTON
SWISS TYPE
GEAR HOBBERS

for accuracy and speed in hobbing pinions, gears and sectors.

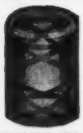
Two Models
No. 00 SPUR GEAR HOBBER for work up to 2" dia.
No. 1 SPUR and SPIRAL GEAR HOBBER (Illustrated) for work up to 6" dia.

Write for further details to
Triplex Machine Tool Corp.
Exclusive Sales Agents
125 Barclay St., New York 7, N. Y.
Manufactured by
THE HAMILTON TOOL CO.
Hamilton, Ohio

Consult
"NEWARK GEAR"
On Your Manufacturing Problems
Gear Cutting Machines

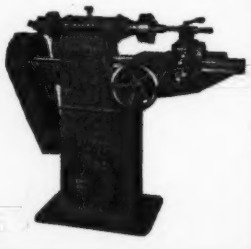
Gear Specialists since 1904

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect St., NEWARK 5, N. J.
FRANK E. EBERHARDT, President



Let Us Show You What You Can Do With This Versatile
FISCHER OIL GROOVER

These versatile machines are saving money and speeding production in all kinds of shops, producing straight or spiral, internal or external grooves with standard equipment. *Write for our bulletin that will show you the many jobs which the Fischer Oil Groover can do in your shop.*



PROMPT DELIVERY!

FISCHER MACHINE CO.
310 N. Eleventh St., PHILADELPHIA 7, PA.

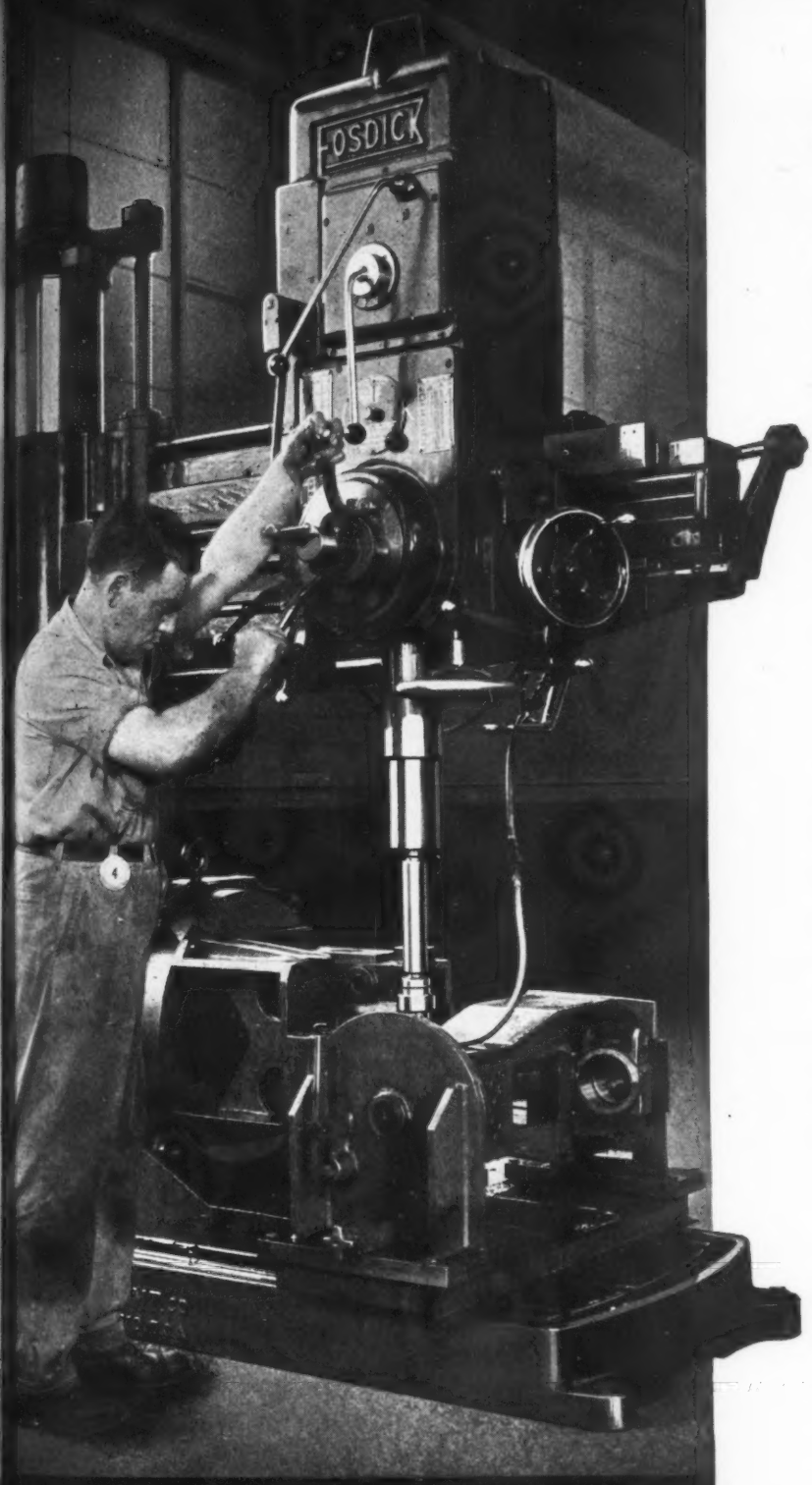
LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS · CRANK SHAFTS

Drilling and Tapping Machines
(Automatic and Semi-Automatic)
LELAND GIFFORD CO.
WORCESTER, MASS.

TIME IS VALUABLE
USE COLUMBUS TIME-SAVING
JIGS DIES FIXTURES

We are specialists in saving time, in cutting costs, in speeding up all types of operations. Let us show you how Columbus-designed Jigs, Dies, Fixtures and Special Machinery can improve your production.

THE COLUMBUS DIE, TOOL & MACHINE CO., COLUMBUS, O.



Another "FUSSY" AIRCRAFT JOB PERFORMED ON A FOSDICK RADIAL!

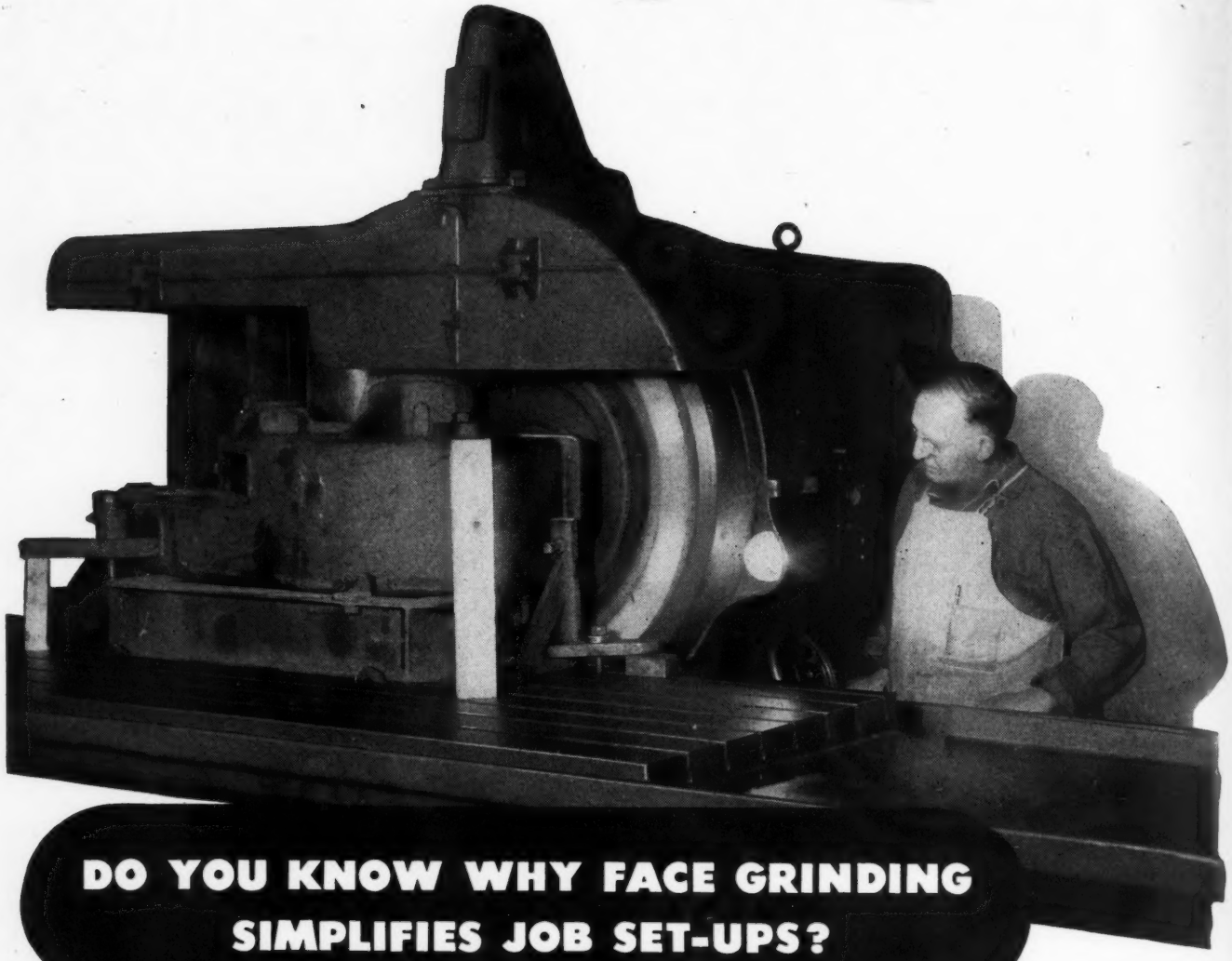
★

Details are withheld on this job being performed in a plant of the Curtiss-Wright Corporation, but it is one requiring a high degree of accuracy, both in regard to the diameter and the center-to-center location of the many holes being drilled and bored. On this job, where accuracy over a large layout of holes is essential, Fosdick Hydraulic Variable Rapid Traverse to Head and Hydraulic Column Clamping speed operation. The ease and convenience of Fosdick centralized control and the simplicity of changing tools for various operations and different diameter holes accounts in a large measure for maintaining a high production rate on this type of work. Whatever the operation—if it's a radial job it's a job that a Fosdick Radial can perform to wartime standards of speed and accuracy.

Write for Bulletin RM.

ECONOMAX *Hydraulic* **RADIALS**

FOSDICK MACHINE TOOL COMPANY
CINCINNATI • • • OHIO



DO YOU KNOW WHY FACE GRINDING SIMPLIFIES JOB SET-UPS?

Some machining methods require complicated set-ups, due to the need for bracing in all directions against the forces of the cutting tool.

Face grinding with a Diamond Face Grinder eliminates these costly set-ups. Very often you can use fixtures made right in your own shop, improvised from scraps of metal or even *wood.* You save time and material. You can set up jobs quickly and inexpensively as shown above.

Look into this and other advantages of Diamond Face Grinders. Mail the coupon for complete details. And remember, the Diamond Face Grinder requires no previous machining skill or knowledge. In a few days to a few weeks an operator can be trained for fast, accurate work.

Diamond Machine Company of Philadelphia
2435 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Send me your folder explaining the advantages of face grinding and features of the Diamond Face Grinder—("Philadelphia Type").

Name_____

Company_____

Address_____ State_____

City_____

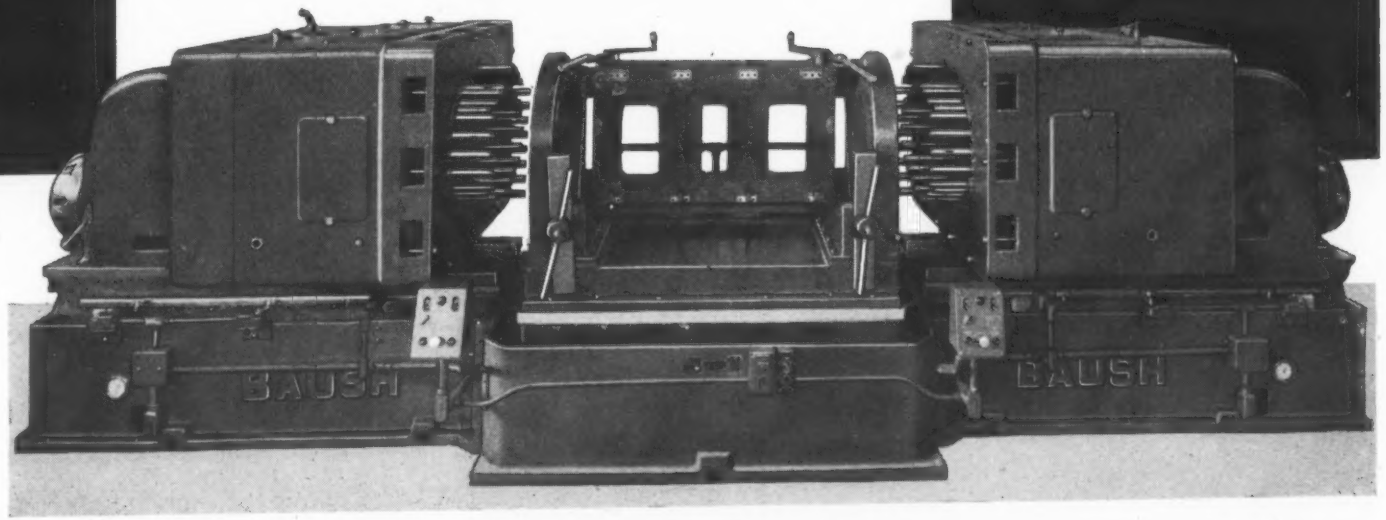
DIAMOND
MACHINE COMPANY
OF PHILADELPHIA

Subsidiary of American Engineering Company, builders of fine machinery for over 75 years, and manufacturers of Taylor Stokers, Marine Deck Auxiliaries, Lo-Hed Hoists, Heel-Shaw Fluid Power.

BAUSH 50 YEARS OF PROGRESS

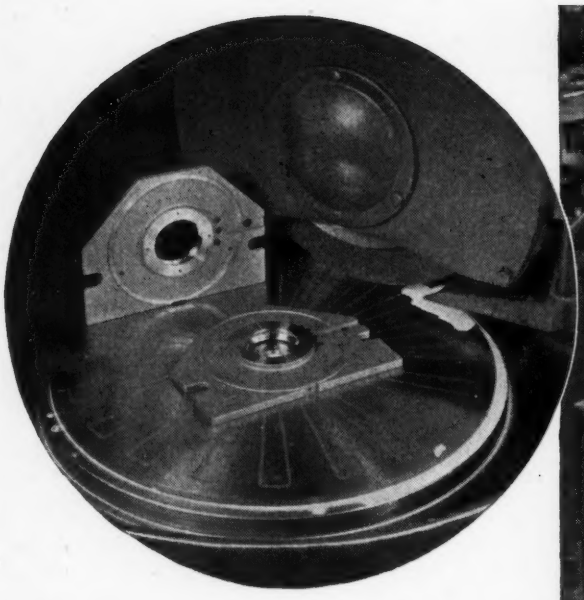
★ Baush-designed, Baush-built, this recently completed heavy duty Horizontal Multiple-Spindle Drilling Machine is especially adapted to drilling the tough metal used in tanks, army trucks, etc. With an approximate weight of 40,000 lb., ruggedness and sustained precision are assured. Extreme flexibility in drilling layouts results from such features as: hydraulic feed, adjustable drill heads, universal joints. Note spindles attached to precision-bored, double-decked cluster plates. Drilling area of each head is 30" x 54". Width of way is 26", and a 30-HP motor powers each head.

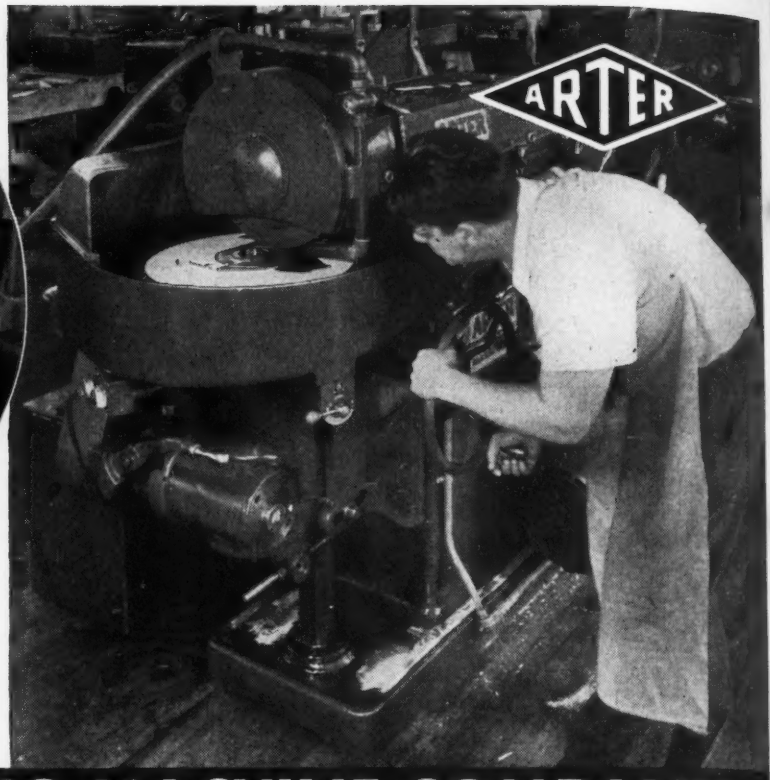
Fifty years ago Baush pioneered in the design and construction of multiple-spindle machinery to put such operations as drilling, boring, tapping and reaming on a high production basis. The intervening half-century of experimenting and perfecting has developed tools like this Drilling Machine; tools doing their share to help speed today's production . . . . and tomorrow's Victory.



Baush high production machines can help YOU attain greater speed and productivity in multiple-spindle production. Write for full data.

BAUSH MACHINE TOOL CO., *Springfield 7, Mass.*



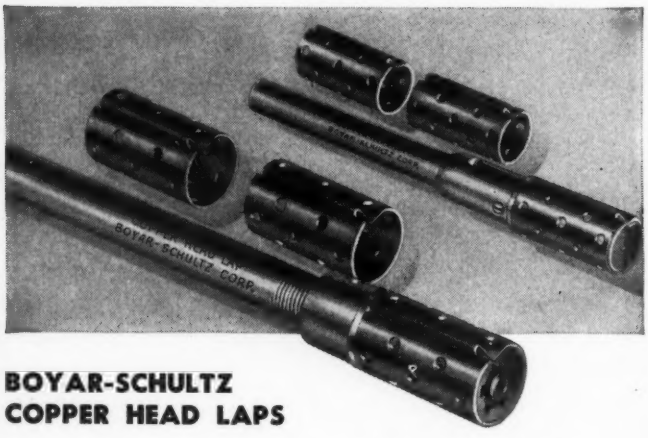


For general tool room grinding. Model A-3 Rotary Surface Grinder at Vinco Corporation, Detroit. Simple to operate ... produces good finish ... holds work to close tolerances. Production increase—50 to 100%.

ARTER GRINDING MACHINE COMPANY

ARMY E NAVY

WORCESTER, MASSACHUSETTS • U. S. A.



BOYAR-SCHULTZ COPPER HEAD LAPS

Consider the time saved in the tool room and in production when you use Copper Head Laps instead of making laps in your own shop. But that is not the only saving . . . Copper Head Laps do not wear out. The only wearing part is the inexpensive, replaceable copper sleeve. Adjustment feature permits maintaining correct lapping size till the sleeve is worn out. It is then replaced with a new correctly sized sleeve. Available from stock in standard sizes, 1/8" to 2 1/2".

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WARDWELL No. 57T Automatic Circular Metal Saw Grinder

Fully automatic and precise sharpening of slitting and screw slotting Saws and Milling Cutters. Capacity includes saws up to 8" in dia., in range up to 3¾" thick. Automatic indexing and accuracy within ±.001" of exact diameter of entire lot. This machine pays for itself many times over — a "must" for Economy in high production shops. Illustrated Bulletin gives all details.

THE WARDWELL MFG. CO.

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The Most Complete and Up-to-the-Minute Line of Diamond Tools. Send for Catalog. Distributed through Mill Supply Jobbers.

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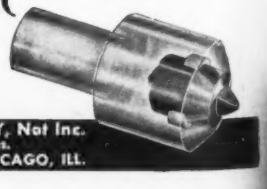
Cooler dressing
Closer Tolerances
Micrometer Accuracy

Because: Wing key heat dissipation and absolute diamond lock nib.



DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, Pres.
938 E. 41st Street CHICAGO, ILL.

GRAND RAPIDS

Hydraulic Feed SURFACE GRINDERS

'ROUND-THE-CLOCK PRECISION AND SMOOTH OPERATION

In plants engaged in all types of precision war production, Grand Rapids Hydraulic Feed Surface Grinders are proving their dependability under the severest kind of operating conditions. The No. 25 Grinders shown in the toolroom of a well-known plant now engaged in 100% war production, are popular wherever operations on small work require high accuracy. Other larger models are capable of grinding to an equally high degree of precision on large work and on production operations.

The massive, one-piece column and base found in all sizes assures permanent alignment of vertical and horizontal ways. Rigid, precision mounted spindle can be controlled vertically well within limits of .0001". Hydraulic table feed produces smooth work and permits speeds to be infinitely varied for best finish and maximum production. Two spindle speeds permit use of worn wheels with equally fine results.

These and more features are described in Bulletin GL-100. Write for your copy.

GALLMEYER & LIVINGSTON CO.

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THEY STAY TRUER . . . LONGER

High quality grinding becomes high economy grinding with VITRIFIED WHEELS. They stay truer—longer. They will not gum or glaze. And they are not affected by heat, cold, oils, or acids.

Let our engineers study your grinding jobs and make recommendations for greater service and economy. No obligations, of course.

VITRIFIED WHEEL CO.
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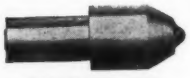
PERFORMS MANY JOBS!

Greenfield

No. 4 TOOL and CUTTER GRINDER

In toolroom or in plant, there's hardly a precision grinding or sharpening job the Greenfield No. 4 Tool and Cutter Grinder can't do, and do well. As a standard grinder, it can be used for all types of tools and cutters. Equipped with special fixtures, it does cylindrical and internal grinding accurately over a wide range. The No. 4 Machine illustrated has an 8½" swing over table, length of 22" between centers, table surface of 5½"x28". Adjustments accurately calibrated for quick settings. Sturdy construction. Write for bulletin.

PRODUCTION MACHINE CO.
GREENFIELD, MASS.



DESMOND NIB

Desmond DIAMOND *Tools and Nibs*

DESMOND DIAMOND HAND TOOL

For diamonds and diamond tools, for prompt remounting service, for wheel dressing equipment of all types . . . come to Desmond-Stephan. Wheel dressing specialists for 35 years, we can advise you on the selection of the correct equipment for every job. Write for bulletins and get our quotations on your diamond requirements.

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Special GRINDER for
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Precision-built for accurately and quickly sharpening Carbide Tools. Sturdy ½ h.p. ball-bearing, reversible motor; 6" Silicon Carbide wheels and large adjustable tool - rest tables..... **$95**

1 Year Guarantee

We also manufacture
GENERAL PURPOSE GRINDERS
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BATTERY CHARGERS for Industrial and Automotive use. *Write for Bulletins.*

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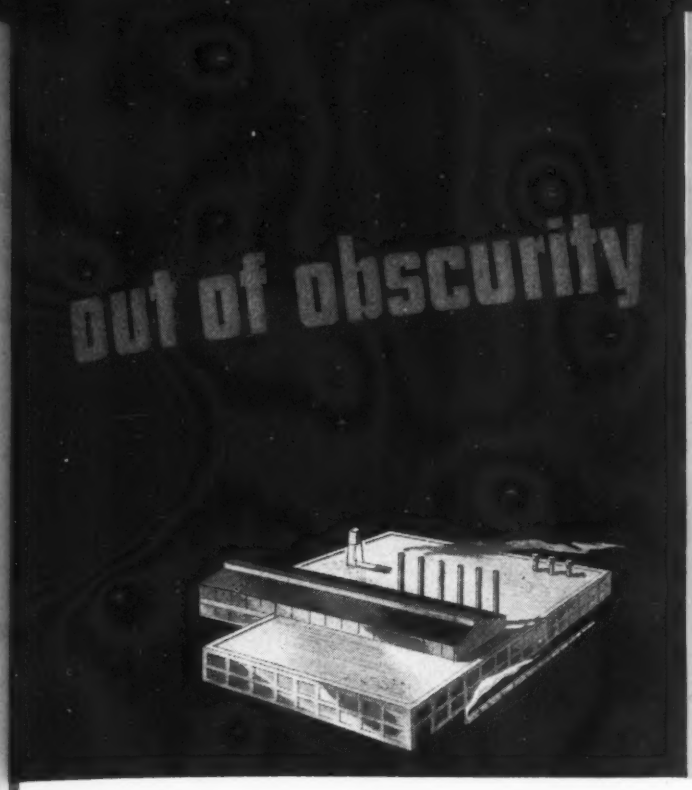

There is a brighter side. From $319 in 1914, net income per capita in these United States climbed to $875 (est) in 1943. Increase in cost of living jumped 76% in the 1913-1918 period of War I. The first five years (1938-1943) of World War II show a climb of 24%. Close of 1944 may well see an accumulated "buying reservoir" of $100,000,000 in American socks. Your plant expanded for war. How about your vision? Has it expanded to include the "peacework" future? To turn a profit, then, calls for turning, now, from production at any cost to production at lowest cost. Look at your lathes, for instance. Then look to LeBlond.

THE R.K. LeBLOND MACHINE TOOL CO., CINCINNATI, 8

NEW YORK 13, 103 Lafayette St. CAnal 6-5281

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- ☐ No. 2 CUTTER GRINDER

YOUR NAME _____ TITLE _____

YOUR FIRM _____ ADDRESS _____

time to retool

Turn to LeBlond for Turning Equipment

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

ARMY-NAVY

LeBLOND

★ YOUR BONDS BUY BOMBS ★

BUY A "BLOCK-BUSTER" TODAY!

HD Engine Lathes—Nine sizes ranging from 12" to 50" swings. For versatility in turning.

Automatic Lathes—12" & 16" Mechanical or Hydraulic power.

Super Regal Lathes—Six sizes, 13" to 24" Best for training.

Automatic Crankshaft Lathes—For all facing, turning, finishing, pins.

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HD Gap Lathes—Ten sizes in Regular and Sliding Gap models.

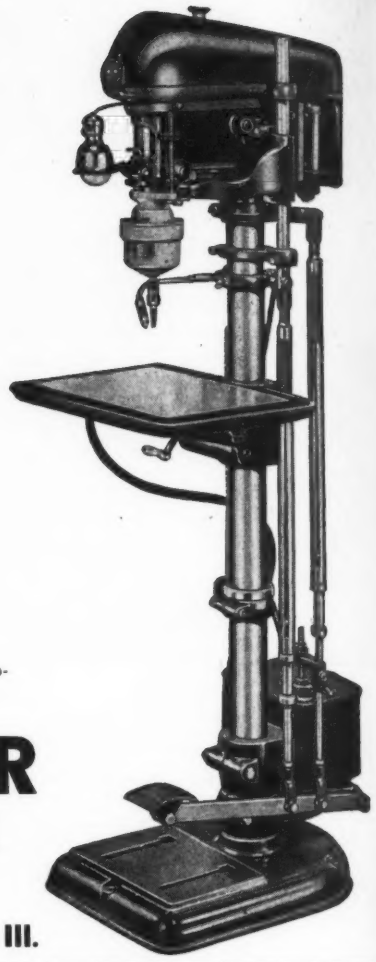
Rapid Production Lathes—13", 17", 20" swings. Six speeds. Faster output. Lower cost.

No. 2 Cutter Grinder—Internal, cylindrical, face and angular work.

TESTS PROVE

That this Universal Tapping Machine Affords:

1. GREATER SENSITIVITY
2. INCREASED OUTPUT
3. LESS TAP BREAKAGE



Actual comparative tests in shops by users of Procunier Tapping Machines prove that these machines definitely speed up tapping operations, do more accurate work and reduce tap breakage. There are specific reasons for this superior performance of Procunier machines: 1. The improved Procunier tapping head with double-cone cork-face friction clutch and other exclusive features; 2. Four speeds, ranging from 390 to 2050 RPM. efficiently handle jobs for which conventional high speed tapping machines are inadequate; 3. One machine handles tap sizes from No. 2 to ½" through two interchangeable heads; 4. Extra long Spiral Compensating Springs conveniently located, with wide range hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF OPERATOR.

Send for Bulletin—giving full details, description and prices on the Procunier Universal Tapping Machines, the Procunier Precision Tapping Heads and the new Tru-Grip Tap Holder.

PROCUNIER SAFETY CHUCK COMPANY
16 S. Clinton St., Chicago, Ill.
Send me bulletins on: ☐ High Speed Tapping Heads. ☐ Tru-Grip Tap Holders. ☐ Universal Tapping Machines.
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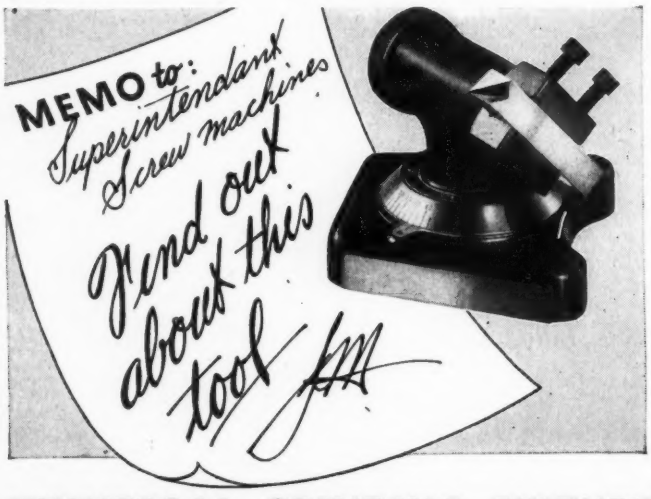
PROCUNIER
SAFETY CHUCK COMPANY
16 S. Clinton St., Chicago, Ill.



UNIVERSAL GRINDING FIXTURE FOR SCREW MACHINE TOOL BITS

Increase screw machine efficiency; reduce costly rejections. Operators with little experience, using Boyar-Schultz Universal Grinding Fixture can quickly produce uniformly ground bits for both right and left screw machine tools, all with exactly the same chip-breaker ground to any desired angle, and to suit any material or condition.

Saves time and material in grinding. Uniformly ground bits save time in machine set-ups.

WRITE FOR LITERATURE

BOYAR-SCHULTZ CORPORATION
Walnut Street at Hoyne — CHICAGO 12, ILL.

Darwin
TOOL STEELS

A NEW CATALOG CONTAINING ANALYSES, HEAT TREATMENT, PERFORMANCE DATA AND RECOMMENDED USES.

This catalog contains up-to-date information on heat treating of tool steel. The steels described in the catalog are specialty products manufactured to lick your tough jobs.

DARWIN & MILNER INC.
highest grade tool steels
1260 WEST FOURTH STREET
CLEVELAND, 13, OHIO

KEYSEATING
(and other jobs)
AT WARTIME SPEED!

Plants engaged in war production are keeping Davis Keyseaters busy on a variety of jobs. The tilting table, high capacity, and quick set-up features make them extremely versatile, useful for many jobs in addition to keyseating. And the Davis broaching pull cut saves time on every job! Write for full details.

DAVIS KEYSEATER CO.
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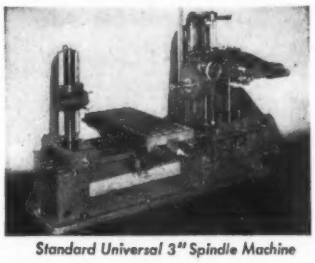
UNIVERSAL *Horizontal Boring Machine*
The only **TRIWAY** *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.
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NOW AND ALWAYS OF

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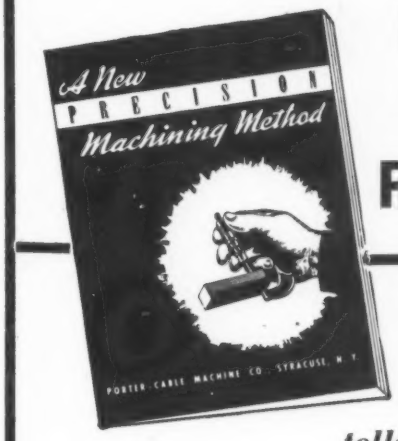
H&G DIE HEAD

See our Advt. on Page 234 January Machinery

INVITATION
to
FASTER, BETTER FINISHING



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WET-ABRASIVE
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. . . the modern method that

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★ is reorganizing manufacturing and assembly procedures, and breaking old, familiar bottlenecks.

Porter-Cable presents all the facts in its latest booklet, "A New Precision Machining Method." It is more than a catalog—it is virtually a treatise on Wet-Belt Surfacing, one of the greatest machining aids to come out in years. Send today for your copy —fill in the coupon below.

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When the war is won—Americans will enjoy higher standards of living than ever before. Motor cars, airplanes, trucks and tractors, home appliances, every machine and tool that's made of metal, will be better, safer and stronger. JKS Diamond Wheels will help to make this possible by processing tougher metals, with greater precision. Far-sighted companies are already designing new products, scanning new outlets and perfecting plans for cutting their costs with improved machine tools. To such executives this is an invitation to write today to—

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REID Automatic Feed Surface Grinder No. 2A

PRICE
$790.00
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A Proven Product for Over a Quarter Century with Thousands in Use Daily

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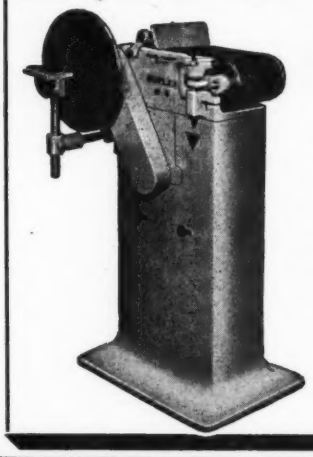

DUPLEX M-6
BAND AND DISC GRINDER

The latest in pedestal type grinders. Actually two machines in one! 14" disc for all rough work . . . 6 x 48" band for finishing. Precision-built to meet wartime production standards—quickly, economically!

Other styles and sizes in New Booklet on Finishing. Write Today.

WALLS SALES CORP.
96 Warren St., New York, N.Y.

The BARNES Motor Driven Precision Cutter Grinding Machine

For Precision Grinding Formed Milling Cutters Used in the Manufacture of Rifles, Pistols, etc.

Write for bulletin giving complete description.

GENERAL MACHINERY CORPORATION
140 Federal St., BOSTON, MASS. Telephone Liberty 4826

JONES MACHINE TOOL WORKS, Inc.
Manufacturers of
VERTICAL SHAPERS • SLOTTERS • STRAIGHT EDGES
VERTICAL BORING MILLS
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SURFACE PLATES AND SPECIAL MACHINERY
King of Prussia, vicinity of VALLEY FORGE, PA.

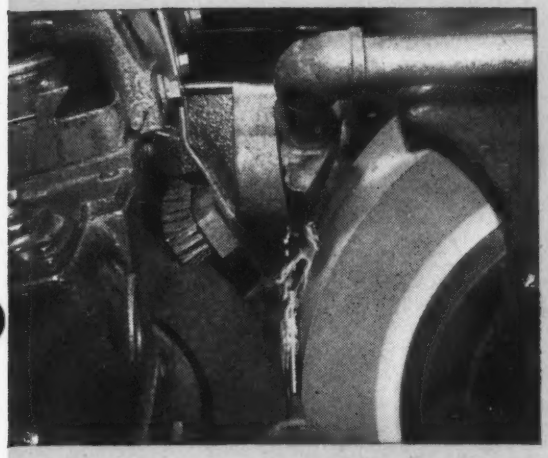
CUTTING TOOL TIPS FROM THE TOP-NOTCHERS

"In Precision Grinding make certain the wheel fits the operation"

says C. E. QUAY, General Mgr.
OHIO TOOL COMPANY
Cleveland, Ohio

GRINDING

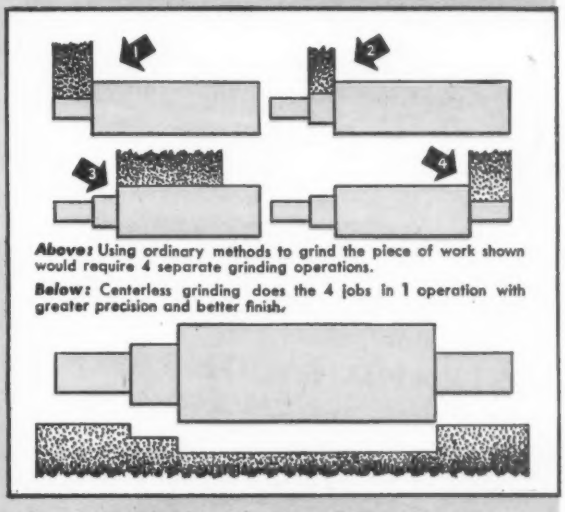
Ohio Tool Company, engaged 100% in war work, is today one of the largest manufacturers of small arms ammunition tools. This accomplishment has been made possible by the development of new methods and equipment, which, in turn, have resulted in a higher rate of production at lower cost.



"TO use a different wheel for every grinding operation in the plant would be a highly impractical and costly proposition. On the other hand, using too few wheels to do a multiple number of jobs sacrifices accuracy and speed of production; requires more manual handling.

"The answer to this problem is profile or centerless grinding . . . a development that grew from the unprecedented production demands of World War II. Precision profile grinding, for example, has made it possible to finish small arms ammunition tools, principally punches, on a production basis. Previously they had been ground singly or a few at a time on conventional tool-room grinding equipment. Internal grinding to finishes of 2 to 4 micro inches is not uncommon on small arms ammunition tools.

"As the sketches below indicate, the ability to centerless-grind several diameters, including tapers, radii, profiles, etc., simultaneously, has reduced what formerly required several operations, to one. In this way, less equipment is needed to produce larger quantities of more uniform tools, releasing additional equipment for other war necessities."



Above: Using ordinary methods to grind the piece of work shown would require 4 separate grinding operations.

Below: Centerless grinding does the 4 jobs in 1 operation with greater precision and better finish.

The proper selection of grinding oils is as important as the selection of the correct grinding wheel. That's why Shell Lubrication Engineers have developed a control technique that "tailor-makes" the oil to fit the machine, the application, and the tool. Ask the Shell man for the details.

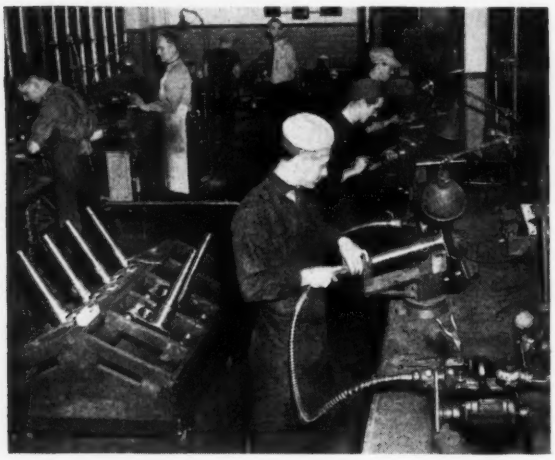
SHELL CUTTING OILS

FOR METAL CUTTING AND GRINDING

SHELL

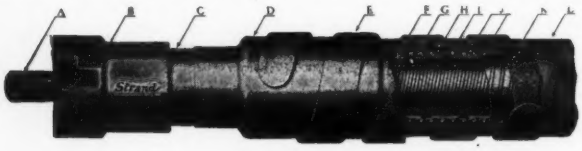
SPEEDING AIRCRAFT ENGINE PRODUCTION!

Easily, quickly, and maintaining the high precision standards demanded in such vital war equipment —a battery of STRAND Flexible Shaft Machines is applied to the polishing of interior surfaces of airplane engine crankshafts at the Wright Aeronautical Corp. The light, easy-to-handle Strand Shaft enables the operator to reach otherwise inaccessible places for such work, too, as grinding, buffing, sanding, drilling, reaming. Write for details!



DETAILS OF STRAND CONSTRUCTION

A—Core End. B—Swivel Coupling Nut. C—Tail Piece for Coupling Nut. D—Ferrule. E—Steel Reinforcement. F—Inside Liner. G—Wire Core Shaft. H—Asbestos Packing. I—Stop Wire. J—Metal Tubing Interlocking Joints. K—Metal Braiding. L—Vulcanized Rubber and Canvas Cover.



N. A. STRAND & COMPANY
5001 North Wolcott Ave., CHICAGO 40, ILL.

Strand
FLEXIBLE SHAFTS

INVESTIGATE Tannewitz DI-SAWS and Youll Want No Other!

Larger wheels (24" diameter on the standard models) provide greater traction, faster, straighter cutting, more production. Transmissions, common source of die saw grief, never fail in TANNEWITZ DI-SAWS. Sturdier, heavier construction throughout, plus many refinements of design, make these machines the greatest trouble-free producers in their field. It pays to buy the best!

With a TANNEWITZ DI-SAW you can do in minutes jobs which require hours by the shaper, miller or lather methods; and there's a size to accommodate work of practically any size. Get the facts. Write for "DI-SAW Bulletin."

STANDARD MODEL No. M24 (24" WHEELS)

Other Bulletins Worth Sending For:

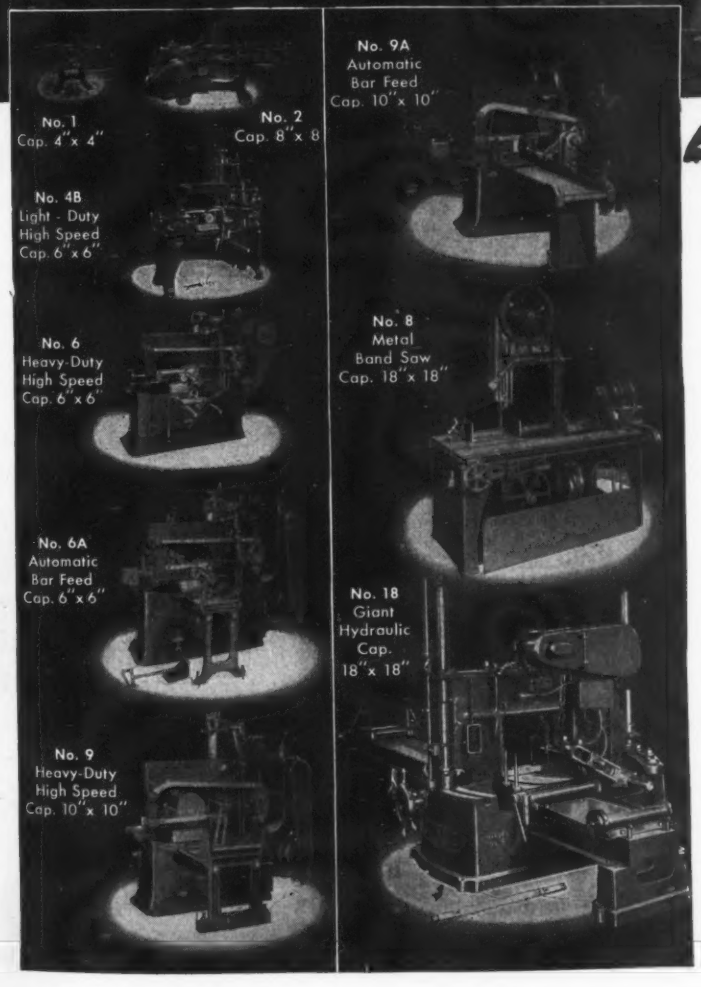
"SINGLE AND VARIABLE SPEED BAND SAWS FOR FOUNDRY USE." "SHEET METAL CUTTING BAND SAWS." A line will bring them promptly.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH

SAWS for ALL METALS

Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

Huther Bros. Saw Mfg. Co.
ROCHESTER NEW YORK



MARVEL SAWS

How would *you* do it?

(Cutting an I-Beam that has been rolled into a large diameter ring into segments. A typical example of the versatility of the No. 8 MARVEL Band Saw)

At the Kling Bros. Engineering Wks., Chicago, manufacturers of rolled structural shapes, three MARVEL No. 8 Metal-cutting Band Saws are proving "A-1" and "100%". In the MARVEL System there are saws exactly suited to every shop's need—and for structural shapes, the universal MARVEL No. 8 is ideally suited, because it handles all work up to 18" x 18" cross-section and does cutting-off, mitering and notching. The blade feeds into the work at any angle from 45° right to 45° left. It is the most versatile metal-cutting saw built.

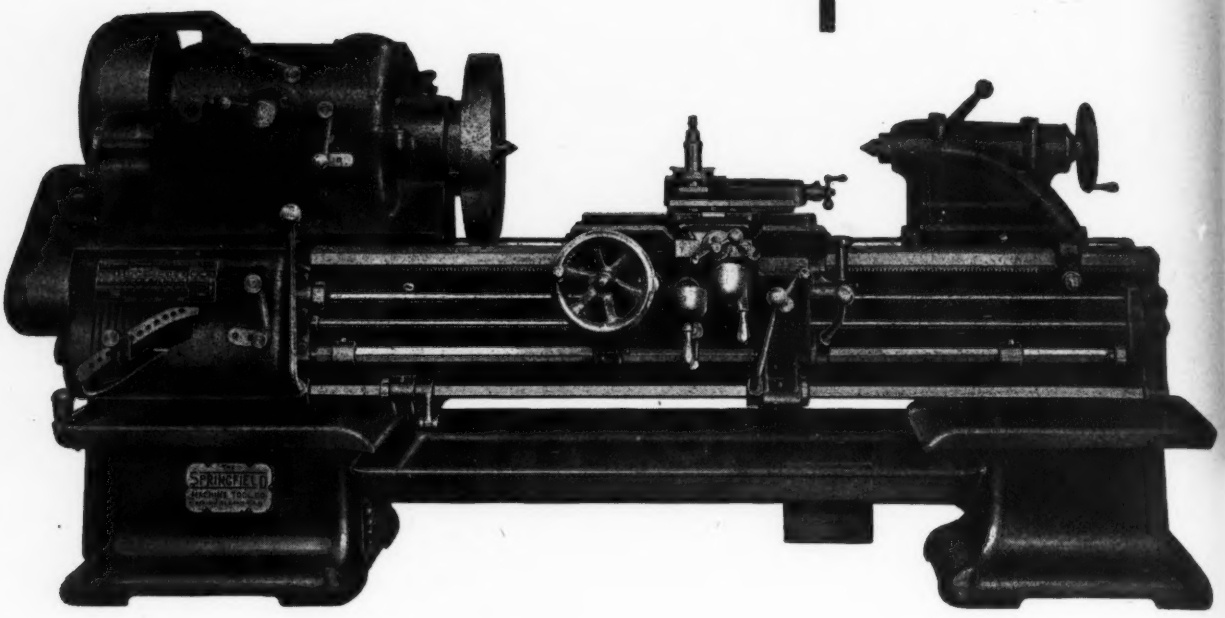
ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York

FOR 1944 . . . AND AFTER!



Geared to the needs of this crucial year—and ready for long post-war service, too!

Last year saw heavy production—but during this decisive year 1944, as the Big Push gets into swing, the "tools of Victory" will be called upon to meet even heavier schedules. Springfield Lathes are ready . . . ready to meet schedules "on time" and with the full measure of precision demanded in the manufacture of combat goods. Assuring speed, accuracy, dependability, are such features as these: Permanently true Bed, made of a special high-test alloy insuring wear resistance and rigidity even under the heaviest of roughing cuts . . . extra heavy semi-steel Apron . . . firm, sturdy Compound Rest . . . efficient Power Transmission and Lubricating Systems. These and other advantageous features of Springfield design and construction are your guarantee of outstanding lathe performance under 1944 production schedules—and point to continued years of useful, profitable life in the peace to come.

★

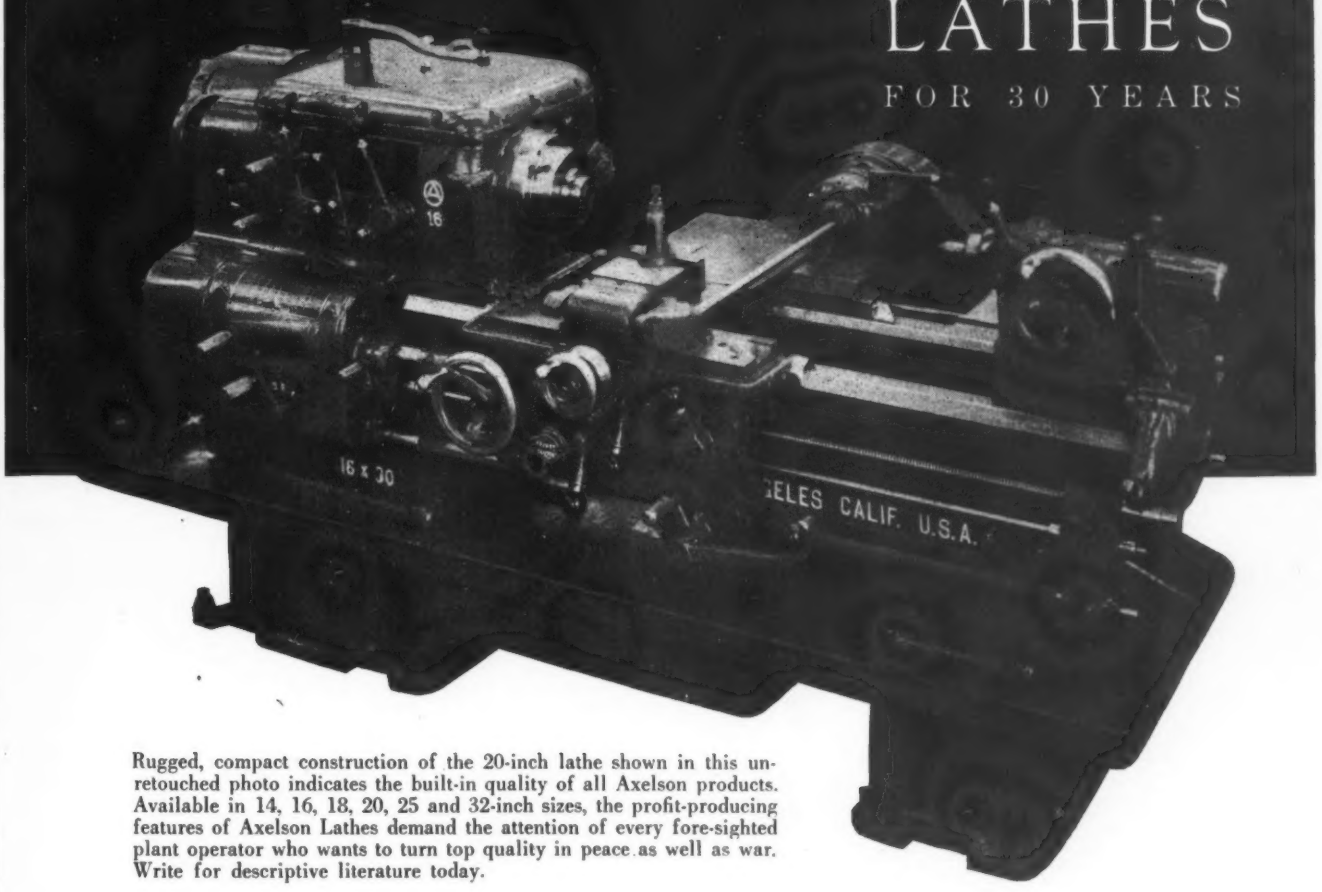
Springfield Lathes are built in sizes from 14" to 30"

SEND TODAY FOR BULLETIN NO. 162

THE SPRINGFIELD MACHINE TOOL CO.
SPRINGFIELD, OHIO

AXELSON

THE OUTSTANDING NAME IN *QUALITY* LATHES FOR 30 YEARS



Rugged, compact construction of the 20-inch lathe shown in this unretouched photo indicates the built-in quality of all Axelson products. Available in 14, 16, 18, 20, 25 and 32-inch sizes, the profit-producing features of Axelson Lathes demand the attention of every fore-sighted plant operator who wants to turn top quality in peace as well as war. Write for descriptive literature today.

Axelson Lathes have been making productive history on every Allied machine tool front where close-tolerance precision is a fighting necessity. But history making in production is an old story with Axelson Lathes — their thirty years of dependable quality and proven design have built an outstanding reputation for fast accuracy on every type of job in the turning field.

Axelson engineered features, exclusive on Axelson Lathes are fighting for Victory now. These same features, plus war-born new developments, will continue to build the Axelson reputation on thousands of post-war products after Victory.

Remember — the lathe you buy today will be turning out your peace-time products to a highly competitive market. It takes quality lathes to turn quality products — and there is no economical substitute for Axelson quality.

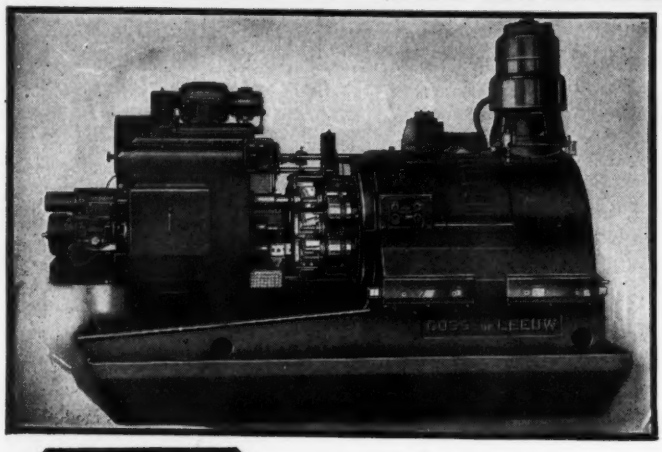
Before you buy any lathe investigate AXELSON!

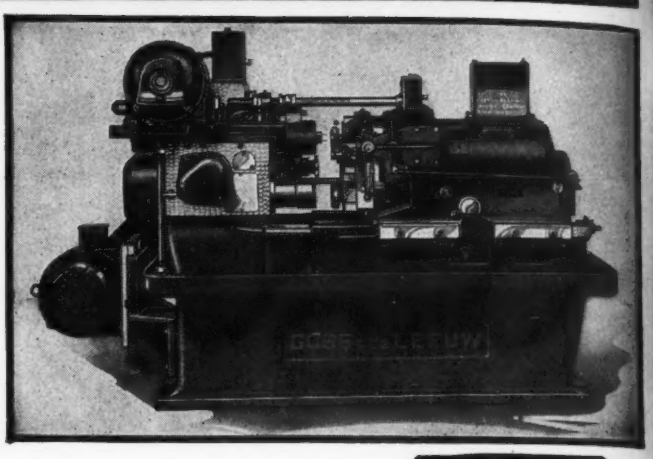
AXELSON MANUFACTURING COMPANY

6160 SO. BOYLE AVE. (Box 98, Vernon Station) LOS ANGELES 11, CALIFORNIA

50 Church St., New York • 204 Munsey Bldg., Washington, D. C. • 3844 Walsh St., St. Louis

GOSS & DE LEEUW Multiple Spindle CHUCKING MACHINES





WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

Features include:
Lead Screw Threading on both types—Pre-loaded Anti-friction Spindle Bearings—Hardened Ways—Oversized Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

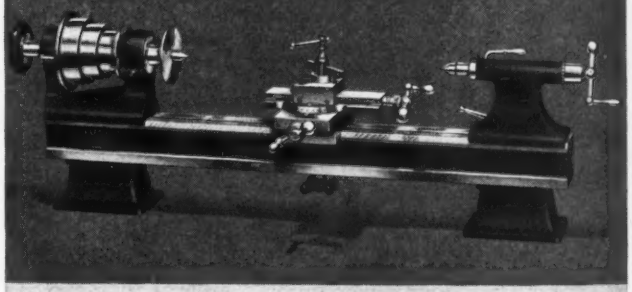
IDEAL SPEED LATHES

are performing secondary-finishing operations on small metal and plastic parts – more quickly, more accurately, at lower cost! Ideal for polishing, de-burring, lapping, filing. Quality engineered. Built for precision performance in continuous, 24-hour-per-day service!

A size and type for every purpose. With air-cooled, dust-free single or two-speed motor, conventional or special holding devices; exclusive, automatic brake, etc. State your problem. Write for Catalog No. 440.

SCHAUER MACHINE COMPANY
ORIGINATORS OF TODAY'S SPEED LATHES
2069 READING ROAD --- CINCINNATI 2, OHIO

AMES No. 3 . . . Precision Bench Lathe



Known for 40 years as a precision lathe of the highest quality. Widely used in tool and instrument manufacture when fitted with lever operated attachments. Bed 36" long. Ball bearing headstock uses 1" capacity collets. Swing 8 3/8" over bed. Available with motor drive.

Send for Catalog

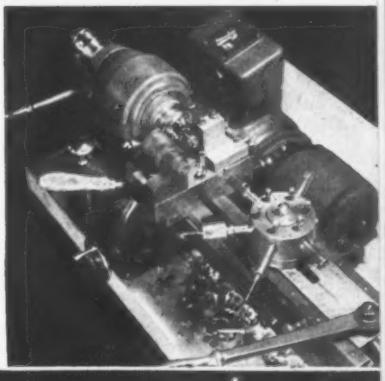
B. C. AMES CO.
WALTHAM, MASS.

"Stark"

Integral Drive

PRECISION BENCH LATHE

A new stream-liner incorporating all the old Stark accuracy and stamina

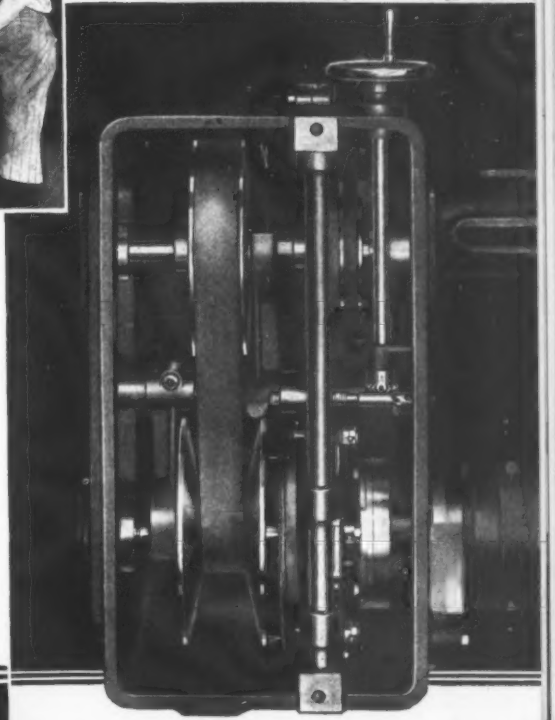


THE first tool of its class with built-in Motor and speed changing mechanism (patented). Marvelously compact; nothing under the bench; no special bench or cabinet needed; even bolting down unnecessary:

Simply moving control lever to right engages the clutch, vertical position releases; moving to the left instantly brakes the moving spindle.

Standard (tool room) Model has time-tried double taper spindle bearings 156 to 2200 r.p.m.—the best for sustained accuracy.

High speed (manufacturing) Model fitted with best precision pre-loaded anti-friction bearings, 260 to 3500 r.p.m.



Both have 40 inch bed, 9 inch swing, 20 inches between centers; either ¾ or 1 inch collet capacity. Take regular STARK Attachments collets and chucks. This Stark (patented) built-in drive, integral with the Lathe itself, employs a ½ h.p. geared ball-bearing motor drive through a disc clutch, and through V belts to the headstock, giving any split speed at the turn of the small hand wheel in front of operator.

Write for full information

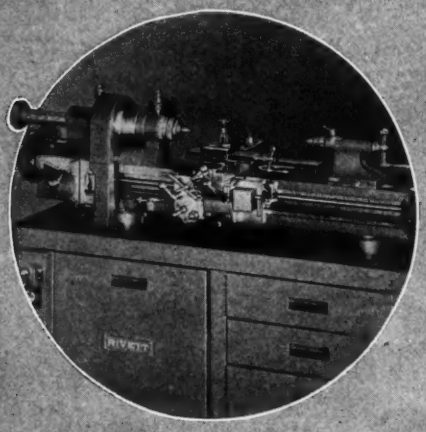
STARK TOOL COMPANY

WALTHAM, MASS., U. S. A.

ESTABLISHED 1862

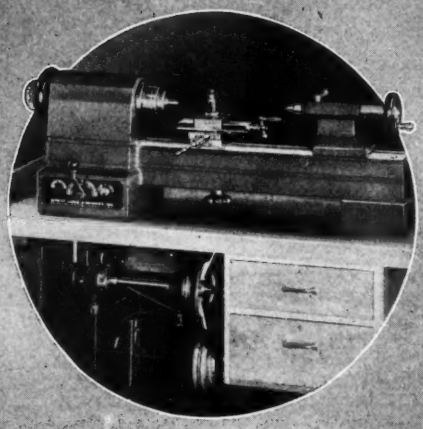
ORIGINATORS OF THE AMERICAN BENCH LATHE

RIVETT



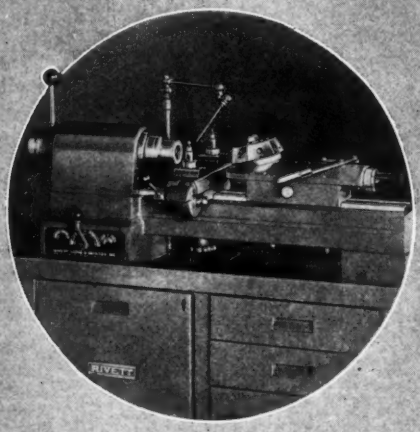
TOOL-ROOM LATHES

RIVETT 608 back-geared, screw cutting lathe is recognized the world over for its ability to produce fine work within guaranteed precision limits. In manufacturing, tool-making and experimental work, it will handle a great variety of parts in minimum time. Finely made attachments for milling, spiral cutting, slotting, relieving, taper turning, ball turning, grinding, forming and multiple operations are available. Swing is 8½" dia.; center distance is 18¼"; collet capacity is 1" max.



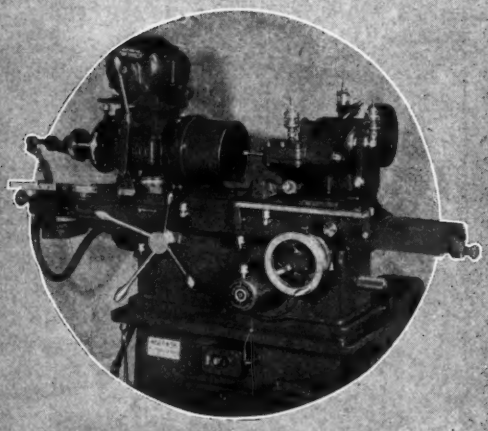
PLAIN BENCH LATHES

RIVETT plain precision bench lathes have vastly increased the earning power of such machines. An engineered unit, a Rivett lathe is quick to set-up, has wide speed range, power and vibrationless performance and is capable of many jobs often produced on heavy, costly machines. Two sizes are furnished: Series 715 has 7" dia. swing, 15" center distance and ¾" max. collet capacity; Series 918 has 9" dia. swing, 18" center distance and 1" max. collet capacity.



HAND SCREW MACHINES

RIVETT 918 hand screw machine incorporates precision, balanced design and operating features to make it an efficient producer on small duplicate parts. Bar stock passed through spindle may be held in push-out collet, while work individually chucked may be held in draw-in collet, step chuck or jaw chuck. In combination with six turret operations, double tool cross slide can be furnished for straight or taper turning, forming or cutting-off. Swing is 9" dia. and collet capacity is 1" max.



INTERNAL GRINDERS

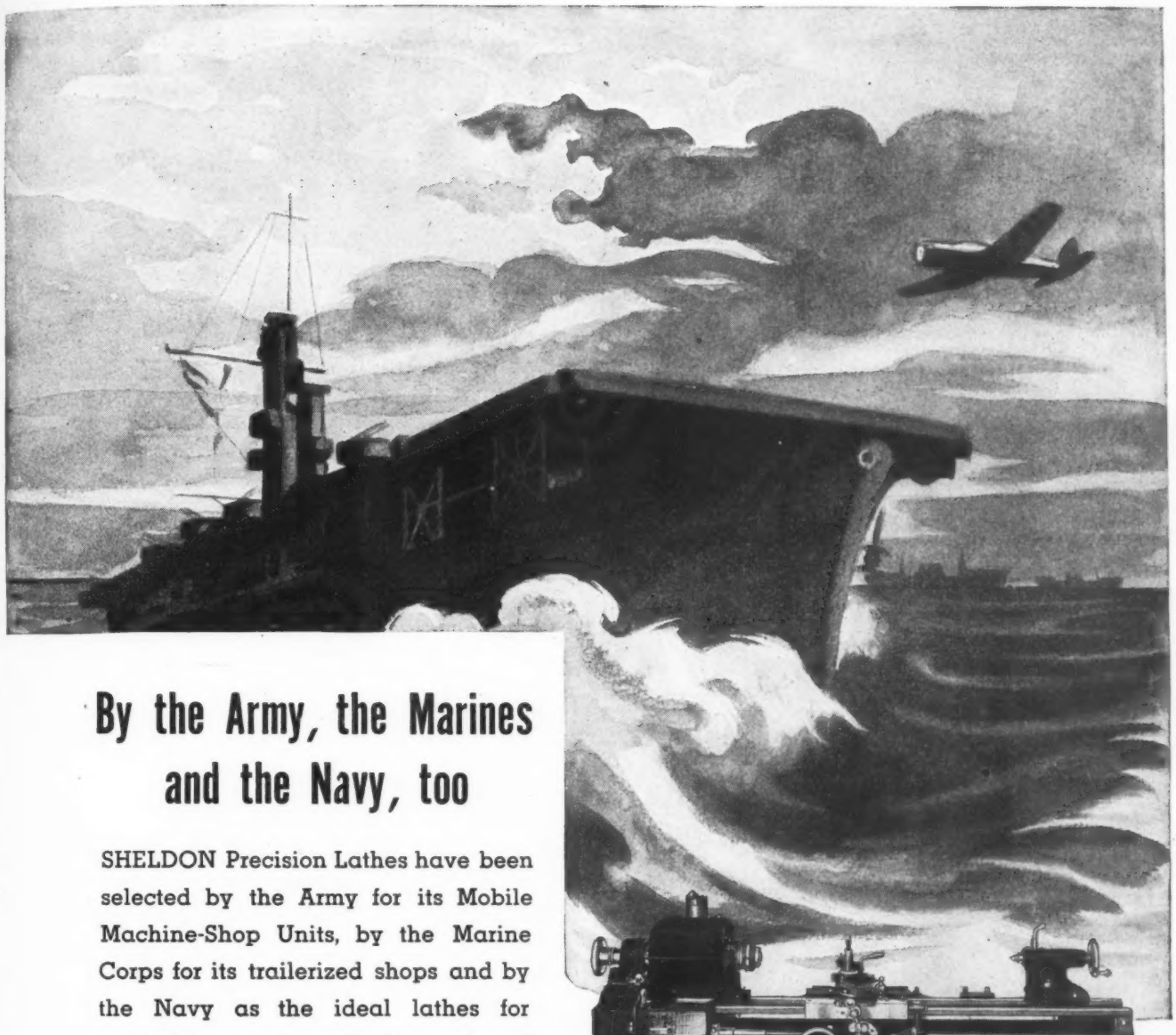
RIVETT internal grinders are primarily designed for tool room work, however, are used extensively in precision manufacturing. Available internal and external spindles in combination with many adjustments make possible a great variety of grinding operations. Two sizes are furnished: Series 104 has internal and external grinding capacity up to 3" dia. with power table travel up to 4"; Series 112 has internal and external grinding capacity up to 8" dia. with power table travel up to 8".

Write for General Bulletin 500

ARMY E NAVY

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS., U.S.A.



By the Army, the Marines and the Navy, too

SHELDON Precision Lathes have been selected by the Army for its Mobile Machine-Shop Units, by the Marine Corps for its trailerized shops and by the Navy as the ideal lathes for several types of repair shops aboard ship and ashore.

SHELDON Lathes are also widely used in British, Canadian, South African, Russian and other allied factories to speed the production and maintenance of war material . . . proof of worldwide SHELDON accuracy and dependability.

SHELDON 10" (1-inch collet capacity) Precision Lathe and Bench Unit with E-type underneath motor drive.

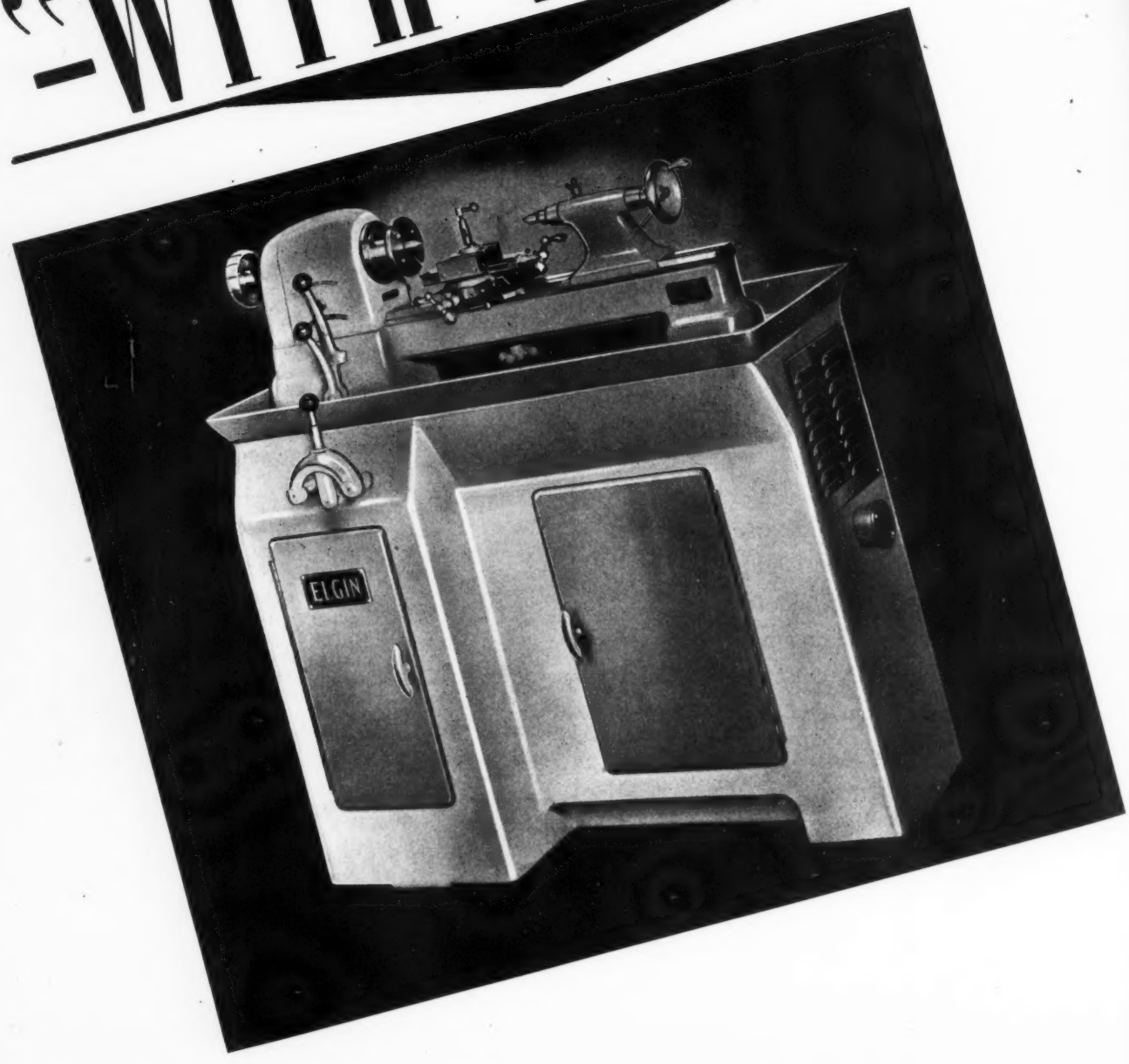
SHELDON

SHELDON MACHINE CO., INC., 4246 N. KNOX AVE., CHICAGO 41, U. S. A.

All Three of these new Elgin Precision Tools are equipped with a VARIABLE SPEED DRIVE which places at the operator's fingertips any speed in a wide range of RPM. Instantly — without stopping spindles, without shifting belts—he can obtain precisely the correct speed for every operation, hence the maximum precision on fine work!

The new Elgin PRECISION BENCH LATHE (below) has a Variable Speed Drive making quickly available any speed from 120 to 3780 RPM. Steel pedestal base. 1" collet capacity, 9" swing, 17" between centers. For details on this and the other Elgin Precision Tools on opposite page, write today!

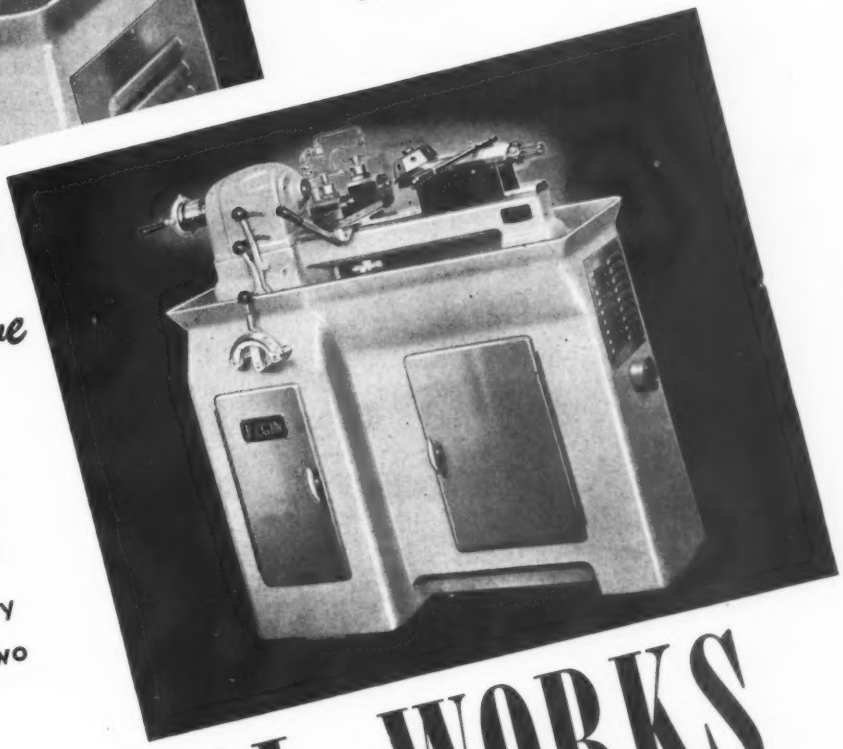
—WITH VARIABLE



SPEED DRIVE!"

HORIZONTAL BENCH MILLING MACHINE
with Variable Speed Drive

Any spindle speed from 85 to 2750 RPM quickly available. No back gearing necessary. Collet capacity, 1". Directly reversible. Table, 4-1/8" wide x 18" long. Longitudinal travel, 12". Transverse travel, 6". Vertical travel, 6". Two speed motor, 3/4-3/8 HP.



HAND SCREW MACHINE
with Variable Speed Drive

Any spindle speed from 120 to 3780 RPM instantly obtainable without stopping spindle or holding up job. 1" collet capacity, 9" swing. Directly reversible. Heavy duty double tool cross slide. Two speed motor, 3/4-3/8 HP.

ELGIN TOOL WORKS

1770 BERTEAU AVENUE, CHICAGO 13, ILL.

MOREY TURRET LATHES
for BAR or CHUCKING { UNIVERSAL or PLAIN

3 UNIVERSAL

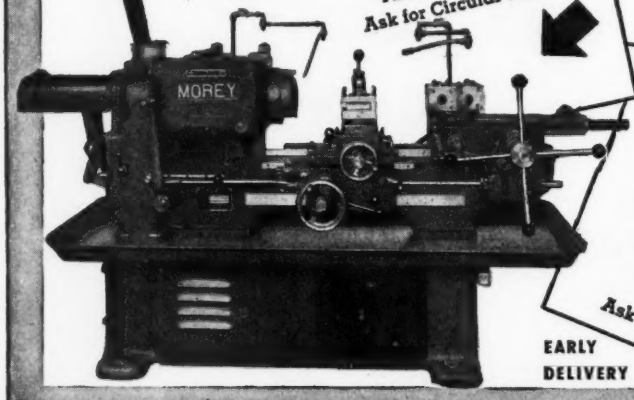
For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM, constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 727A

2 PLAIN-GEARED

For bar stock up to 1" in diameter
Turning length 6½"
Swing over cross slide 6"
Swing over bed 14"
Infinite spindle speeds:
Minimum of 60 RPM.
Maximum of 2000 RPM.
Constant horsepower at all speeds.
Ask for Circular 629A

4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length
19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM, constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 736A



EARLY DELIVERY

INFINITE SPINDLE SPEEDS —Electrically Selected—

DIRECT BELT DRIVE AVAILABLE AT HIGH SPEEDS ELIMINATES GEAR MARKS (patents applied for).

GEARED SPINDLE SPEEDS INSTANTLY AVAILABLE THROUGH MULTIPLE DISC CLUTCHES.

SPINDLE MOUNTED ON TIMKEN BEARINGS.

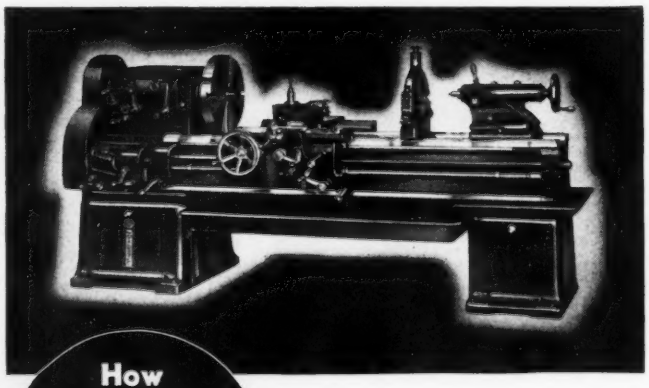
RIGID—WITH SUFFICIENT POWER TO TURN AT THE HIGHEST SPEEDS AND FEEDS *MODERN* TOOLS WILL WITHSTAND.

SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.

ARMY E NAVY

THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC
410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK



How to keep your *Metalmaster* working for Victory!

Before mounting FACE PLATES—

The face plates furnished with your Bradford Lathe are accurately fitted, and they should be maintained in good condition if accurate work is expected from your lathe. Take these precautions before mounting a face plate on the spindle: (1) Be sure the bore and thread of the face plate are clean and free from dirt, chips and burrs. (2) See that the spindle nose is likewise clean, checking over the thread and shoulder. (3) Oil the threads of the spindle, so that the face plate will go on and come off easily. And remember not to jam it on too tightly, as removal later on may be difficult.

Face plates on your Bradford are held central and true by a doweled fit at the rear of the threads, but it is well to make doubly sure by observing the foregoing precautions. Even a little imperfection at one of these vital points makes a big difference in the quality of the work turned out.

THE BRADFORD MACHINE TOOL CO.
671 Evans Street, Cincinnati, Ohio

1840 - 1944

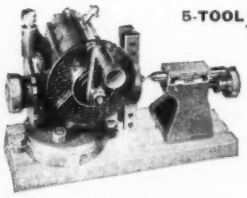
Convert any engine lathe into a turret lathe in 15 seconds with JEFFERSON TURRET ATTACHMENTS. To fit bench lathes and lathes up to 24" swing.

● This new modern TOOL-POST TURRET (below, right), made in two sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard tool holders which are easily inserted and rigidly held. **6 Days Delivery.**

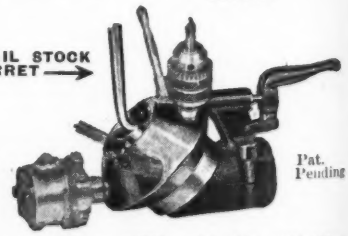
Pat. Pending

4-TOOL TOOL-POST TURRET

● Then there's the completely modernized 5-tool TAIL STOCK TURRET (below, right), made in 4 sizes to fit small bench lathes and lathes up to 24" swing. Also the adjustable PULL FEED LEVER. Jefferson Turrets are real production tools —substantial, rigid, accurate. They must not be confused with the small make-shift gadgets now on the market.



5-TOOL TAIL STOCK TURRET →



Pat. Pending

Above: 7½" Swivel Base Dividing Head.

IMMEDIATE DELIVERY

● Also—Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.

JEFFERSON MACHINE TOOL CO.
673-773 W. 4th STREET, CINCINNATI, OHIO

WHEN COLLET WORK IS INDICATED - SPECIFY

Precision Collets

IMMEDIATE DELIVERY FROM STOCK

GUARANTEED UNCONDITIONALLY, AND AVAILABLE IN THE WANTED MODELS FOR MOST IMPORTANT LATHES INCLUDING SOUTH BEND, ATLAS, LOGAN, SHELDON, ETC.

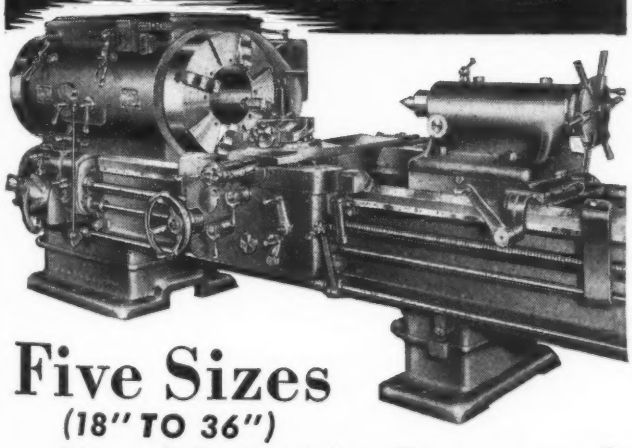
MODEL 3AT for 10" Atlas; Logan, 12" Craftsman, No. 700 Powr-Kraft • MODEL 3C for 8 & 9" South Bend, 12" Clausing, Hardinge No. 3, 10" LeBlond, etc. • MODEL 1A for 8 & 9" South Bend • MODEL 5C for 9", 10", 16", 18" South Bend. Also Sheldon, Schauer, Sebastian 1" Capacity, etc. • MODEL 4C for 14½" South Bend. Also Sheldon, Hardinge No. 4, Elgin ¾" Capacity, etc. • MODEL 480 for Logan Screw Machine, Turret Lathe and attachments. Also Warner & Swasey No. 1, etc.

• Order from your dealer or write us for literature.

GENERAL DIE-STAMPING-TOOL COMPANY
PRECISION COLLET DIVISION 265 Canal Street, New York 13, N.Y.

HYDRATROL LATHES

Large Hollow Spindle Type



Five Sizes (18" TO 36")

Provide Wide Range of Usefulness and Efficiency!

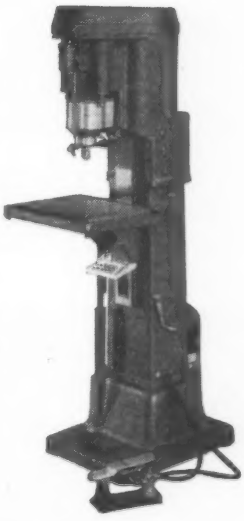
Lehmann MACHINE CO.

CHOUTEAU AT GRAND ★ ST. LOUIS 3

IT'S IN THE *Air!*

AIR CONTROL is the Secret of precision tapping The Haskins Way

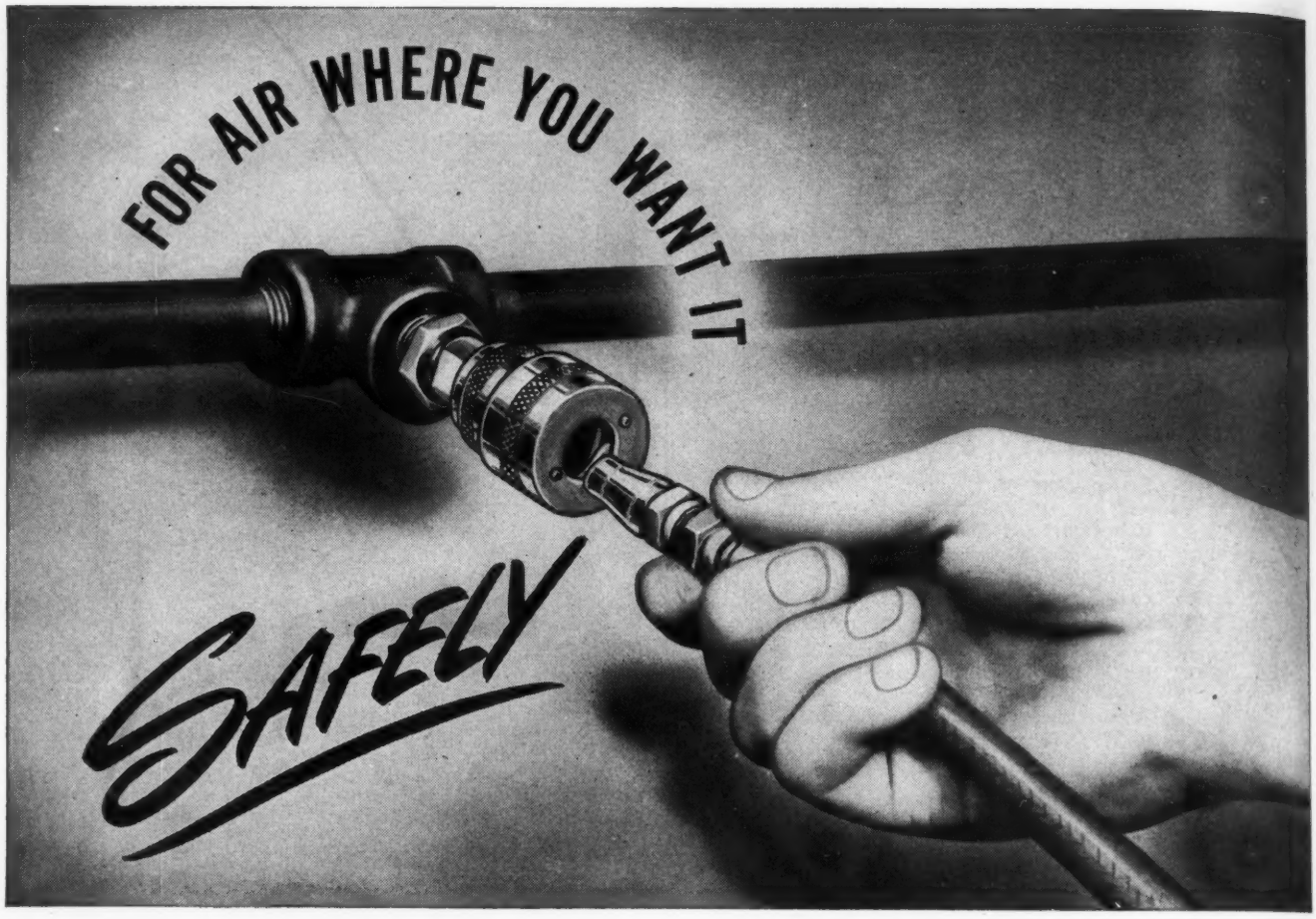
Accuracy—to a class 4 fit when necessary—is constant—each part is tapped exactly like every other, independent of operator efficiency. AIR regulates the complete tapping cycle—not only the down stroke, but its control is so sensitive that the tap is allowed, in effect, to float out of the part. Tap life is longer—tap breakage practically eliminated. Send today for your copy of catalog on Tapping—The Haskins Way. R. G. Haskins Co., 618 South California Avenue, Chicago, Illinois.



HASKINS

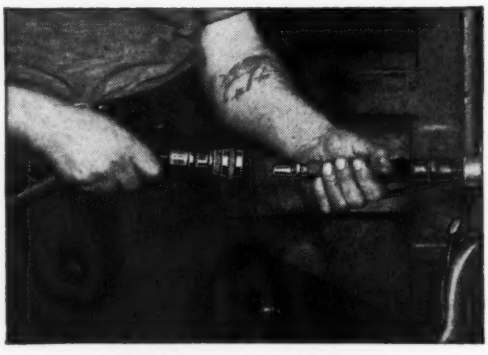
haskins

PRECISION TAPPING EQUIPMENT



INSIST ON

SCHRADER AIR COUPLERS



QUICK-ACTING

SAVES AIR
SAVES TIME
SAVES MONEY

Schrader
REG. U.S. PAT. OFF.
CONTROLS THE AIR

ARMY E NAVY

These days you have to save steps so you certainly want the convenience of plugging in on an air line right next to the job. But when you plug in you want to be sure you stay plugged in until *you* are ready to disconnect. You don't want accidental tugging or tripping to pull out the line, waste air, interrupt work. In using sections of coupled hose, you don't want chance snagging of the coupler—on floor or work to disconnect and whip hose about dangerously.

You need have no worries with the Schrader Swivel Type Air Coupler. It plugs in with one easy push and *locks* automatically. Release requires only a slight twist of the coupler sleeve but it must be a *twist.* Pulling or tugging on the coupler or line can't loosen *this* coupler. See that you get Schrader—the safer, stronger (steel) Air Coupler for all outlets and all air tools.

Order through your distributor or write for details and prices. Send for Catalog No. 10 describing Schrader Quick-Acting Air Couplers and many other Schrader Industrial Products for the effective control and use of *air power.*

SCHRADER PRODUCTS FOR INCREASED PRODUCTION—GREATER SAFETY

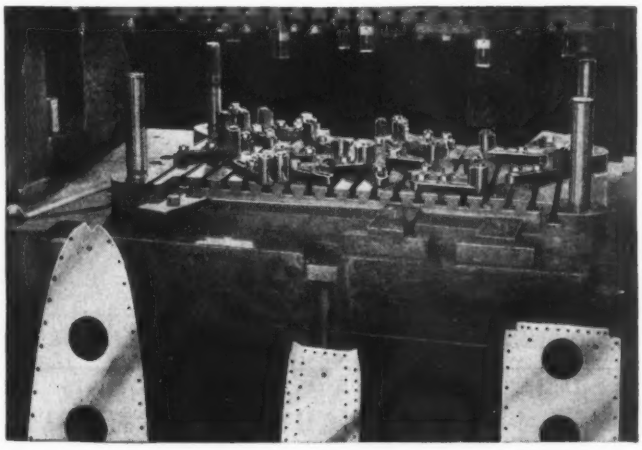
Air Valves, 2, 3, 4-way • Machine Operating Air Controls • Quick-acting Couplers
Blow Guns • Safe Operating Controls • Air Ejection Sets • Hydraulic Gauges

A. SCHRADER'S SON, ***Division of Scovill Manufacturing Company, Incorporated,*** **BROOKLYN, NEW YORK**

YOU COULDN'T ASK FOR ANYTHING MORE SIMPLE — OR BETTER THAN

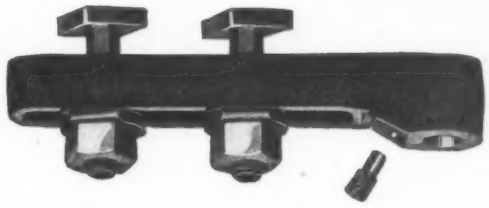
WHISTLER ADJUSTABLE PUNCH and DIE UNITS

Whistler Adjustable Dies work on any type press and because of their simplicity even new workers quickly learn to make pattern change-overs—increasing productive press hours. Absolute precision on short or long runs. Whistler design permits more perforations in a given area—often reducing press operations. For quick and complete information on the advantages of Whistler Adjustable perforating and notching dies send a description or drawing of your work.



These pieces produced with Whistler Adjustable Dies clearly illustrate the re-use of same punch and die units.

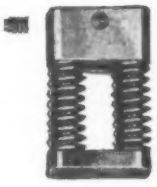
These photographs show the simplicity of a Whistler Adjustable Punch and Die assembly. Every piece is interchangeable.



Self-locking bolts on punch holder drop into T slots of die shoe. Set-screw engages into recess at base of punch. Punch cannot turn or pull out in operation.

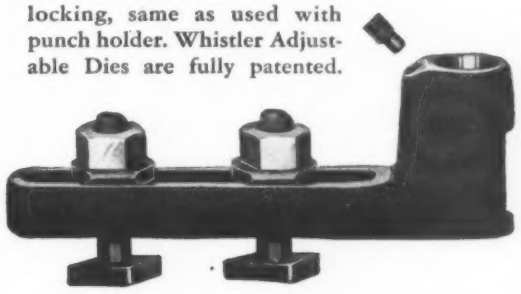
Punches of finest tool steel are machined to .0001″ tolerances.

Stripper unit fits smoothly over punch—no "wobble". Flushed set-screw engages into groove on punch body. Stripper or punch quickly removed when desired.



Grooved heads on dies make lifting from holder quick and easy. Like the punches, dies are held firmly into holder by set-screw in recess at base. Whistler *precision* is known the world over.

Die holder has self-cleaning slug chute. Special design bolt heads present two bearing surfaces to T slot channel—self-locking, same as used with punch holder. Whistler Adjustable Dies are fully patented.

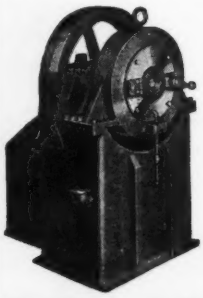


Write for the Whistler Catalog—every Production Executive should have it.

S. B. WHISTLER & SONS, Inc.

Over 25 Years of Tool and Die Making Experience

752-756 MILITARY ROAD BUFFALO, N. Y.



Swaging—*What* it is and *How* it is done on **TORRINGTON SWAGING MACHINES**

All explained in booklet—"The Torrington Swaging Machine"—Your copy mailed on request.

Examples of many possible operations by the Rotary Swaging Method:—

1 Point rods for drawing
2 Pointed rods and tubing
3 Tapered rods and tubing
4 Acetylene torch tips
5 Curling iron tubes
6 Bonding Ferrules to cables
7 Steel furniture legs
8 Tap blanks
9 Banding Rotating Bands on shells
10 Meat hooks
11 Refrigerator expansion bulbs
12 Sizing and Reducing wire

Present Owners of Torrington Swaging Machines are quoted promptly on request for prices for die renewals, etc.

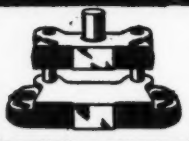
THE TORRINGTON CO.
55 Field Street Torrington, Conn.

BETTER-MADE DIE SETS

BAUMBACH

AT LOWER COST

46 DIFFERENT STYLES



OVER 195,000 SIZES

STANDARDIZED DIE SETS

Machined Steel Semi-Steel

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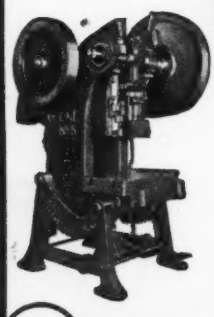
1810 South Kilbourn Ave. Chicago, Ill.



L&J INCLINABLE POWER PUNCH PRESSES

5 TO 79 TONS

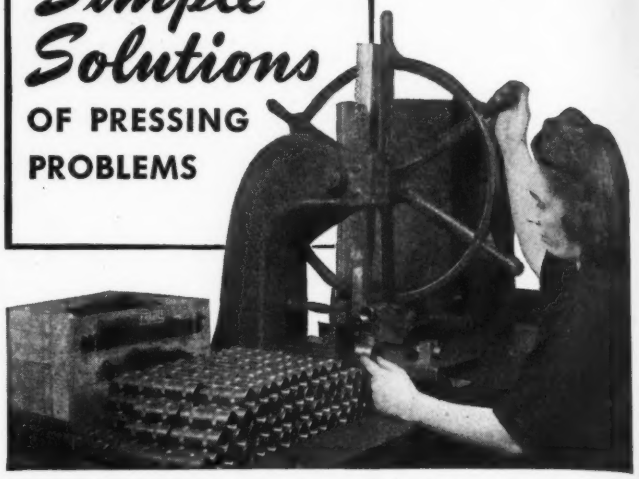
No. 5 BACK GEARED

49 Ton Capacity
45 Strokes per minute
*10¼ Die Space
(Bed to slide, stroke down, adj. up)
4" Standard Stroke
6700 lbs. weight
Also available in plain flywheel type
*No. 5 Special has 15¼" Die Space
Write for New 1944 Catalog

STANDARD SINCE 1911

L & J PRESS CORP. Elkhart, Ind.
1431 STERLING AVE.
SUCCESSORS TO LOSHBOUGH JORDAN TOOL & MACHINE CO.

Simple Solutions OF PRESSING PROBLEMS



Famco Arbor and Foot Presses can simplify a myriad of pressing and punching jobs. • They are low in first cost. • Low in upkeep cost (practically no attention or cost is needed for operation) • Easy to operate (girls can operate all types with ease) • Simple to set up. • Occupy small floor space. There's a model and style of FAMCO ARBOR and FOOT PRESS for every light pressing or punching job. FAMCO engineers will help you select the right press for your problem from over 40 stock sizes. Write for details without obligation.

FAMCO MACHINE COMPANY, 1300 18th STREET, RACINE, WISCONSIN

famco

ARBOR PRESSES
FOOT PRESSES

S&S

QUICK LOADING STOCK REELS

SINGLE INCLINABLE FOR COILED STRIP STOCK

DOUBLE SWIVEL FOR COILED STRIP STOCK

When feeding stock from coils to punch press or any other machine, the S & S Stock Reels make for speed and economy. Easy to load — no screws to loosen or tighten — dependable. Single Inclinable Reel sets in any plane. Double Swivel Reel permits loading of one coil while other is reeling out stock . . . a "reel time-saver."

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GRAY TURRET HEAD METAL CUTTER OR NIBBLER

GRAY, Originator of First Practical Metal Cutter or Nibbler

Most modern Nibbler for Template Cutting, Tool Rooms, Shipbuilding, Aircraft Parts, Aircraft Tubing, Sheet and Plate Shops.

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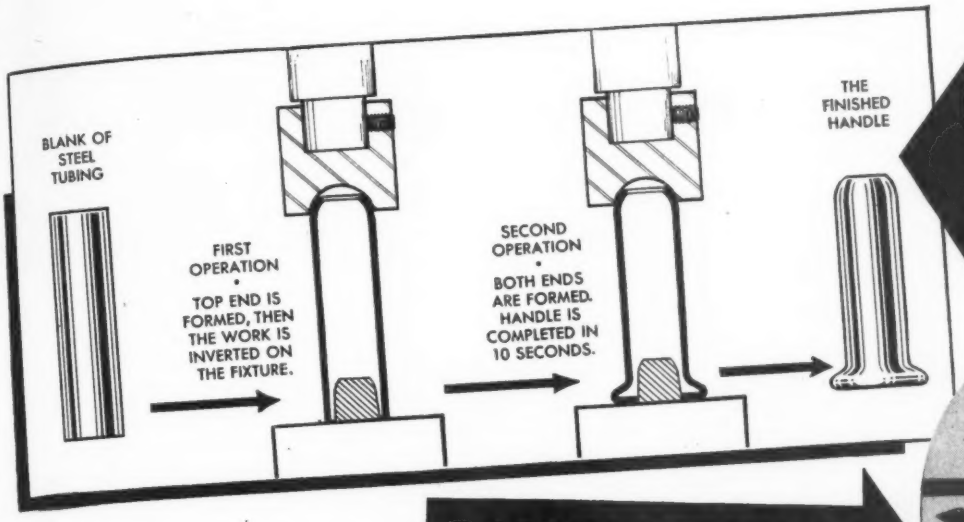
AUTOMATIC MACHINERY BAIRD STRATFORD CONNECTICUT, U.S.A.

MULTIPLE SPINDLE LATHES
MULTIPLE SPINDLE GRINDERS
WIRE FORMING MACHINES
FOOT AND POWER PRESSES
TUMBLING EQUIPMENT

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.

KRW HYDRAULIC PRESSES

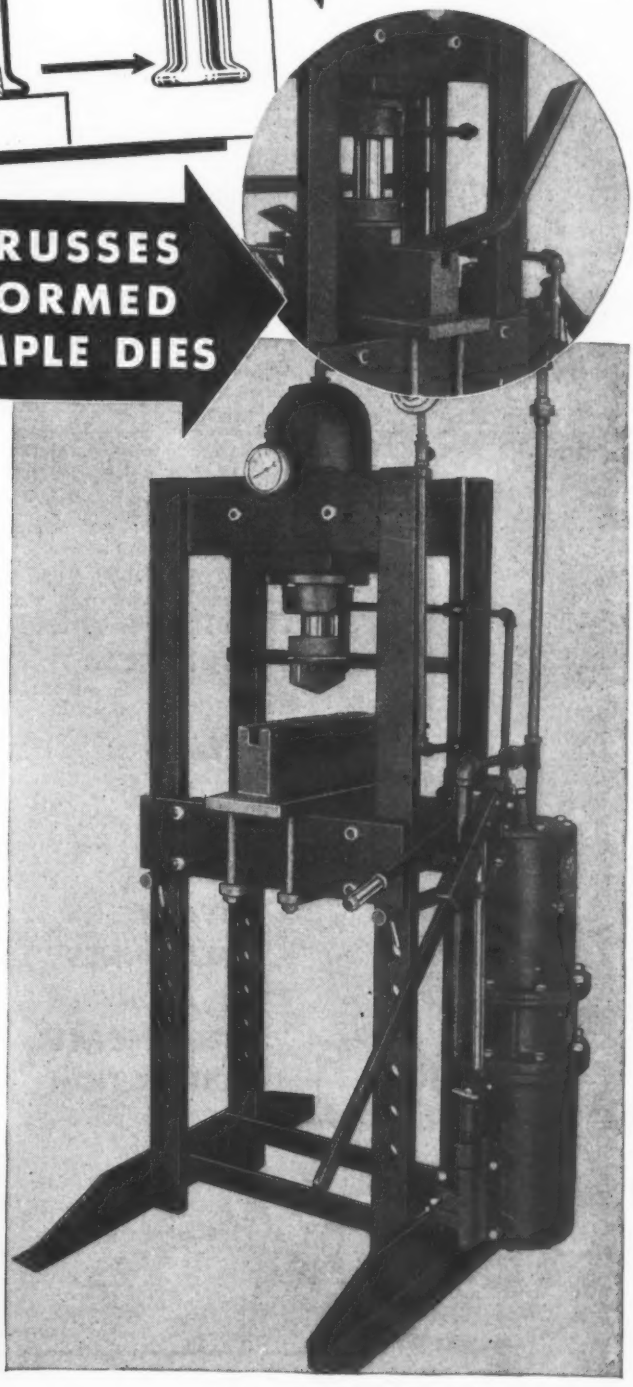
SPEED-UP MANUFACTURING OPERATIONS


BLANK OF STEEL TUBING
FIRST OPERATION
TOP END IS FORMED, THEN THE WORK IS INVERTED ON THE FIXTURE.
SECOND OPERATION
BOTH ENDS ARE FORMED. HANDLE IS COMPLETED IN 10 SECONDS.
THE FINISHED HANDLE

HANDLE GRIPS FORMED IN 10 SECONDS

Both of these jobs are formed on the Special 50-ton KRW Press illustrated lower right. Ram is raised and lowered by an Air Booster which operates the hydraulic oil pump. Press can also be operated manually with the long hand lever.

STEEL TRUSSES COLD FORMED WITH SIMPLE DIES



● Many bending, straightening, flattening, offsetting, assembling and other operations can be performed on KRW Standard and Special Presses by the use of simple, inexpensive dies. The two examples given here are actual manufacturing procedure in our own plant. Press trusses are cold bent from a bar of SAE 1035 steel, 1" x 1¾", which is bent edgewise.

KRW Hydraulic Arbor Presses provide the ultimate in *speed* and incorporate many exclusive features which particularly adapt them to many manufacturing operations. Standard Presses are made in 25, 50, 60 and 75-ton capacities. Special Presses, providing KRW advantages, can be designed to order. Write for our Press bulletin or for engineering assistance on any special problem.

BUILT TO ORDER...PROMPT DELIVERY

K. R. WILSON

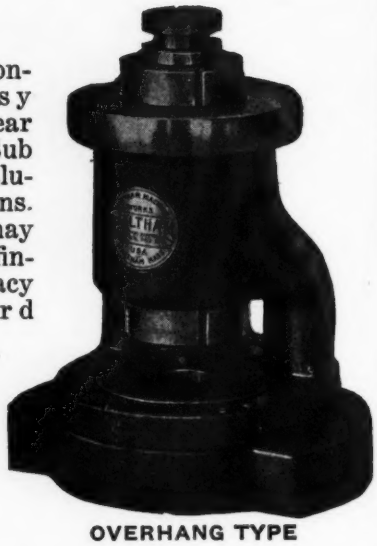
10 LOCK ST., BUFFALO 2, N. Y.

WALTHAM
TRADE MARK
REGISTERED U.S. PAT. OFF.
SUB PRESSES

Accurate—on long runs!

Rigid, precision construction plus easy adjustment for wear make Waltham Sub Presses especially valuable for long runs. Original alignment may be maintained indefinitely, assuring accuracy on second or third operation work.

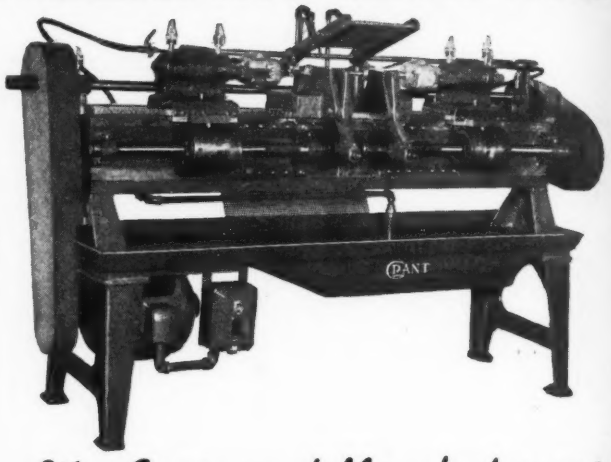
Built with plunger sizes from 1 3/16" to 6", in overhang and arch types. The latter may be used successfully for strip work. Write for descriptive bulletins.



OVERHANG TYPE

WALTHAM MACHINE WORKS
Newton Street, Waltham, Mass.
Makers of Small Thread Millers, Gear Cutters and other Small Automatic Machines

GRANT DOUBLE END AUTOMATIC
THREADING MACHINES



War Equipment Manufacturers!

GRANT Double End Automatic Machines are in universal use for tapping, external threading and reaming operations on various types of munitions. Capacities up to 3/4" diameter, 36" in length. Send samples or prints and get our detailed recommendations.

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N.W. STATION, BRIDGEPORT 5, CONN.

FOR MAXIMUM ECONOMY

ELECTRIC COMBINATION ROTARY MACHINE

in PLANT MAINTENANCE and light PRODUCTION

SHEARS
FOLDERS
BRAKES
FORMERS
ROTARY MACHINES
for all
SHEET-METAL FABRICATION

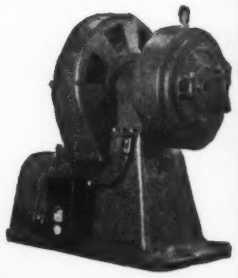
PEXTO

THE PECK, STOW & WILCOX COMPANY
Southington, Conn., U.S.A.
— Since 1785 —

ETNA SWAGING MACHINES

Etna Swaging Machines are built in capacities of 3/8" to 4" dia. with die lengths 1" to 18". Larger sizes built to order.

Write now for booklets!



The ETNA MACHINE Co.
3460 MAPLEWOOD AVE. TOLEDO, OHIO

Hollow Bored Forgings
Lathe and Milling Machine Spindles
Hydraulic Cylinders
Let us have your inquiries on any requirements of Hollow Bored Forgings and Steel Shafts.
AMERICAN HOLLOW BORING COMPANY
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PRESSES
FEEDS
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THE V & O PRESS COMPANY
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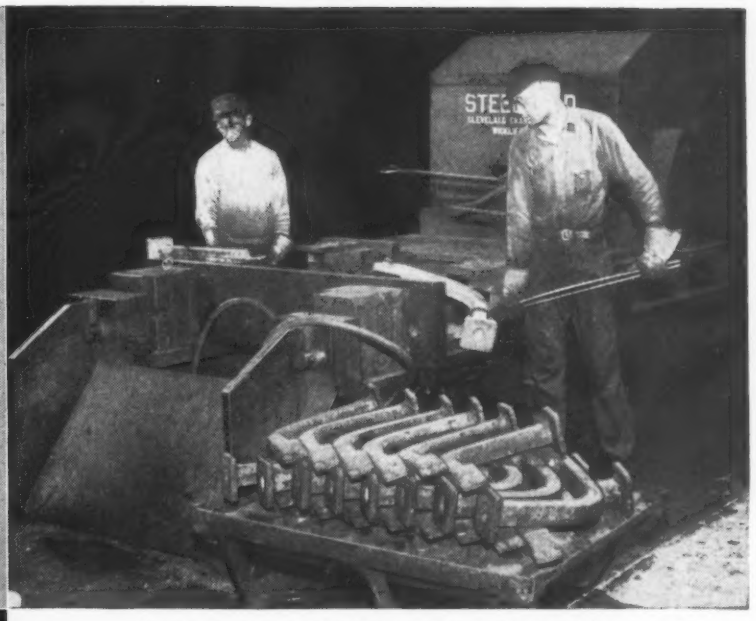
Cleveland
STEELWELD BULLDOZERS

FOR HEAVY POWER REQUIREMENTS



Truck braces made in three operations of .40 carbon steel 2 x 3-inch cross section bent to 5½ inches inside radius. No. 6 Bulldozer.

Bending heavy steel channels to 120 degree angle with top and bottom flange remaining at right angles to web. No. 4 Bulldozer.

Bending and forming a bead in flat pieces of dural for fuel tanks. No. 4 Bulldozer.

Cleveland Steelweld Bulldozers are especially advantageous for the bending and forming of heavy bars and plate, for forging and other work requiring tremendous power. By use of special tools and dies a variety of unusual operations can be performed. Crankshafts and refrigerator cabinets are examples of special work that are produced fast and economically on Steelwelds.

Because the frames are of the all-welded steel construction, far greater strength and rigidity are obtained for the weight of metal used than otherwise possible. Metal is incorporated exactly where the greatest good is accomplished. The frames have no bolted connections to loosen and cause misalignment. Strains are not confined to any single part, but are absorbed by the frame as a whole.

Every working part — drive gears, clutch, brake, ram and slides — have been especially designed to give extra long life and withstand abnormally hard service and even abuse. The splendid record of Cleveland Steelwelds since the first machine was built in 1930 attest to the quality of their construction.

THREE OF THE MOST POPULAR SIZES*

Model No.	Tons Capacity		Face of Ram	Height of End Lugs	Die Space With Ram Forward	Travel of Ram	Strokes Per Minute	Floor Space Required
	Mid Stroke	Bottom Stroke						
4	40	80	9″x56″	8½″	36″	18″	14	5′ 2″x12′ 9″
6	70	140	12″x64″	12″	42″	20″	11	6′ 2″x15′ 4″
8	110	220	18″x80″	16″	54″	24″	10	7′ 4″x19′ 0″

*Data on other sizes furnished upon request.

Descriptive literature gladly furnished free upon request.

THE CLEVELAND CRANE & ENGINEERING CO.

1157 EAST 283RD STREET • WICKLIFFE, OHIO.

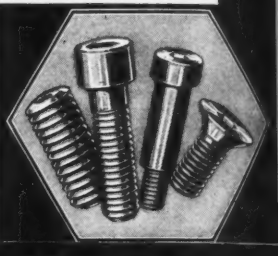
CLEVELAND
STEELWELD BULLDOZERS

GENERAL SALES AGENTS: THE CYRIL BATH CO., E. 70TH & MACHINERY AVE., CLEVELAND

"Hold fast!"

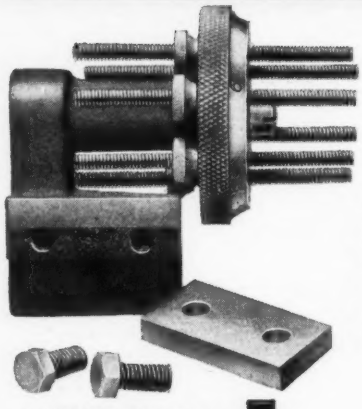
When all depends on *holding fast*, you can depend on ALLENS. In machines of war and machinery of production, "Allens" hold with a grip that never lets go. Made of strongest adaptable alloy steel, formed and threaded by pressure-processes, "Allens" stand punishing set-ups. Precision-threaded to a high "Class 3" fit, they bear evenly on *all* threaded surfaces in the tapped hole. They resist slippage, defy breakage.

Use ALLENS



THE ALLEN MANUFACTURING COMPANY, HARTFORD, CONN., U. S. A.

SPEED PRODUCTION WITH MULTIPLE LATHE STOPS



AMERICAN MODEL CS-1

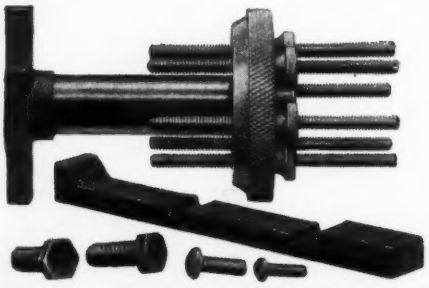
MULTIPLE CARRIAGE STOP

- Sets 6 Stops for Duplicate Operations
- Accurately Gauges Length of Cuts
- Prevents Errors and Rejections
- Any One of 6 Stops Available
- Stops are Numbered and Indexed

Model CS-1 Fits Atlas, Logan, South Bend and Similar Lathes. **$16.75** COMPLETE

AMERICAN MODEL DS-1

MULTIPLE CROSS SLIDE STOP

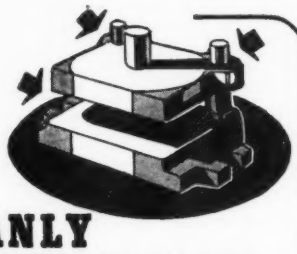


- Sets 6 Diameter Stops for Repeat Operations
- Prevents Spoiled Work
- Increases Production
- Makes It Unnecessary to Work by Dial Graduations

Model DS-1 Fits Atlas, Logan, South Bend and Similar Lathes. **$17.85** COMPLETE

All necessary parts are supplied with each Multiple Cross Slide Stop. Immediate shipments from stock. Rush order and priority today.

SCHULTZ & ANDERSON CO.
108 EDISON PLACE, NEWARK 5, N. J.



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PRECISION DIE SETS
DANLY MACHINE SPECIALTIES, INC.
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THEIR PRECISION
Means Greater Accuracy In Your Production
Danly Commercial Sets
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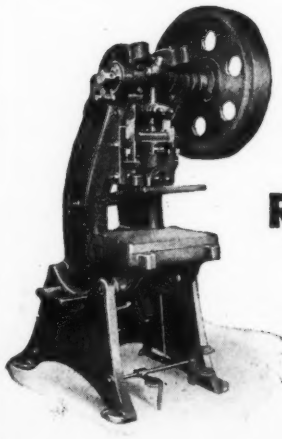


POWER PRESSES
Roll & Dial Feeds

ZEH & HAHNEMANN CO.
182 Vanderpool Street
NEWARK, N. J.

Modern CLEVELAND Presses

This series of Modern Cleveland Presses embraces three distinct types known as: Single Point—Two Point—Four Point, designed with one, two and four connections respectively.

The gears, which run in a bath of oil, are located in the box type crown together with the drive unit and provision has been made for the easy removal of both whenever necessary.

This arrangement of the gearing and drive unit in the crown eliminates the necessity for overhanging brackets or other projections and, as the Presses are symmetrical front and back, this design not only contributes to greater rigidity and ruggedness but also to general compactness with a consequent saving in overall floor space.

These Modern Cleveland Presses can be furnished with either a hydraulically or pneumatically operated friction clutch and brake with electrical control.

When desired, these Presses can be furnished with openings in the uprights to permit feeding the material right and left across the dies by means of Automatic Feeds.

Cleveland Single Point Press. 36" between uprights, capacity 250 tons.

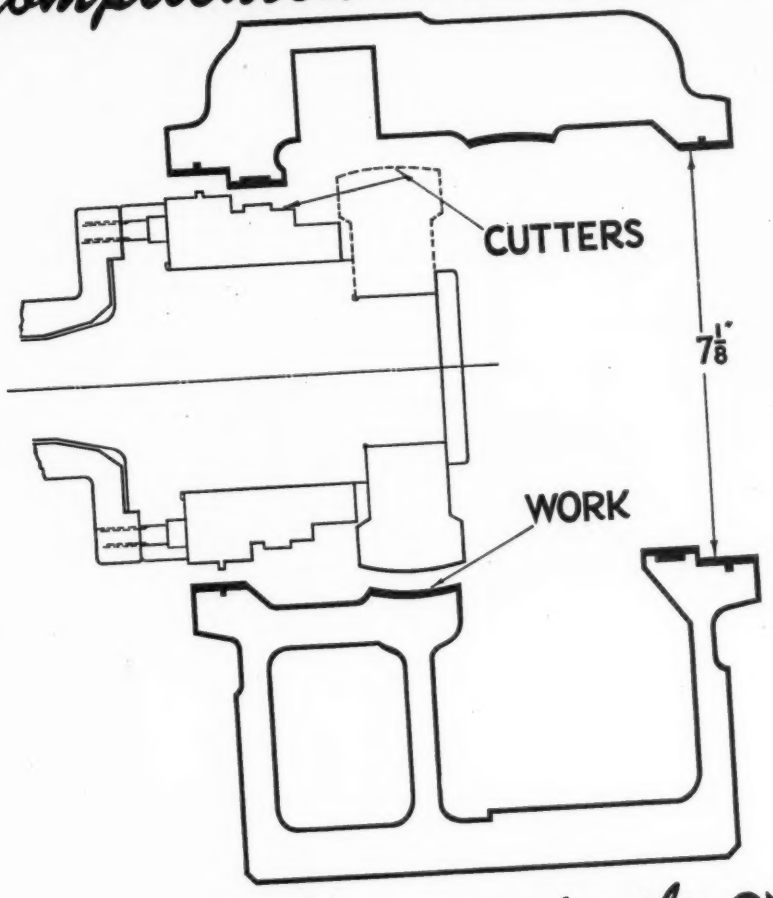
Cleveland Two Point Press, 66" between uprights, capacity 300 tons.

Cleveland Four Point Press, 144" between uprights, capacity 750 tons.

THE CLEVELAND PUNCH & SHEAR WK'S CO. U. S. A.

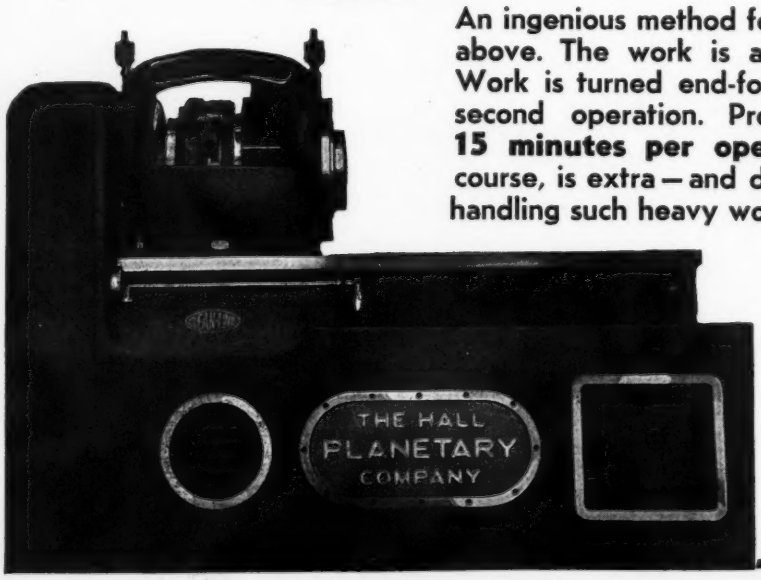
THE CLEVELAND PUNCH & SHEAR WORKS CO CLEVELAND · OHIO

A *Complicated* MACHINING JOB



Write for details!

. . . DONE *quickly, ingeniously* ON THE HALL PLANETARY



An ingenious method for machining complicated parts is illustrated above. The work is a large housing requiring two operations. Work is turned end-for-end and another cutter installed for the second operation. Production on the HALL PLANETARY is **15 minutes per operation.** (Loading and unloading time, of course, is extra—and depends largely upon facilities available for handling such heavy work.)

★ ★ ★

HALL PLANETARY CO.

Fox Street and Abbotsford Avenue

Philadelphia 29, Penna.

Production Doubled with a Roto-Matic Drilling Machine!

● Tooling set-up for drilling the wrench. Part is manually loaded.

200 More Wrenches Per Hour with this *Continuous* Drilling Method

Over six 6-inch wrenches per minute — 400 per hour — were obtained by this manufacturer with the Roto-Matic Drilling Machine, with only one operator. Previous production, using a six-spindle conventional gang drill, was 200 wrenches per hour. The operation consists of drilling a 3/8" dia. hole by 2" deep.

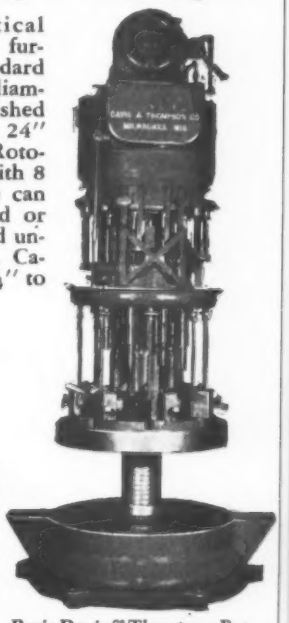
This is just one of many Roto-Matic installations which is setting outstanding production records throughout the metal working industry. Perhaps you can obtain similar or better performance through the application of this principle to your drilling. Our engineers will be glad to work with you in adapting this high production drilling machine to your work. Call on them without obligation.

What the Roto-Matic Principle is . . .

The Roto-Matic Drilling Machine is not an indexing type machine. The drills and work rotate continuously while the operator loads and unloads as the work passes the loading station. Feed to the spindles is obtained through an adjustable cam. The machine can be furnished in both vertical and horizontal models and in addition to drilling, the Roto-Matic principle can be applied to milling, reaming, spinning, counter-boring, spot-facing, balancing correction drilling and similar operations. Investigate the application of this machine or a similar machine to your work today.

The Roto-Matic . . . A Basically Standard Machine for High Production Drilling or Reaming . . .

The Roto-Matic Vertical Drilling Machine is furnished in three standard basic sizes. The 36" diameter Roto-Matic is furnished with 12 spindles. The 24" and 18" diameter Roto-Matics are furnished with 8 spindles. The machine can be provided with hand or automatic clamping and unclamping of the work. Capacities in steel from 1/4" to 2" diameter.



Basic Davis & Thompson Roto-Matic Drilling Machine. Only fixture and tooling are the necessary special engineering required to adapt this machine to an endless variety of work.

Readily Changed from One Job to Another . . .

The spindle feed lengths are governed by cams which can be changed over from one job to another with a minimum of down-time. This makes it possible to run several jobs of moderate-lot sizes over the Roto-Matic and increase production over conventional drilling machines.

A "Pace-Setter" on the Production Line

Since the work is in constant rotation and set at a definite feed rate, the production is pre-determined and the operator need only to unload and load the work as each spindle passes the loading station. This eliminates unnecessary delays in the loading station which are often common with conventional indexing type drilling machines.

Free—This booklet contains other examples of Roto-Matic Solutions, and other high production machines. Ask for Bulletin No. M-244.

DAVIS and Roto-Matic THOMPSON

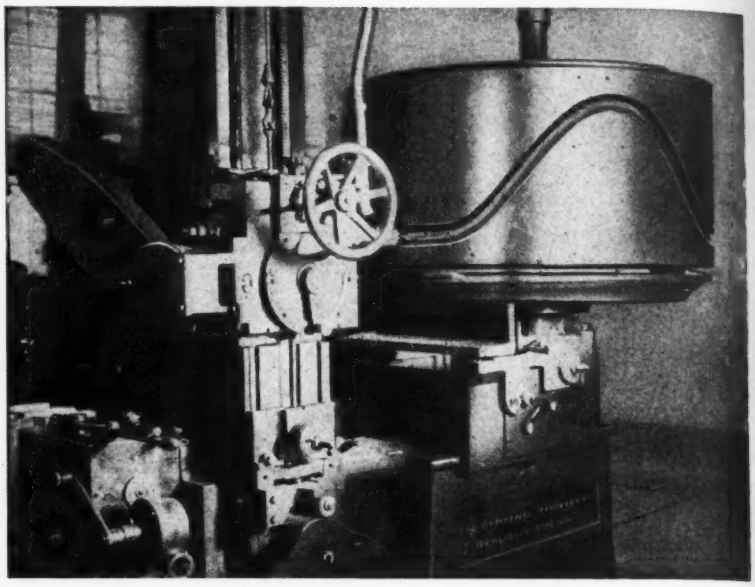
Davis & Thompson Company

MILWAUKEE • WISCONSIN

» » Rowbottom for Cams « «

Save Valuable Production Time!

Don't waste time! Don't tie up valuable production machines! Use Rowbottom specialist service whenever you need cams. We have the experience and the equipment to produce cams of any size or shape, in any material, for any application. Call on Rowbottom whether you need one big cam such as the one illustrated or a thousand or more smaller ones.



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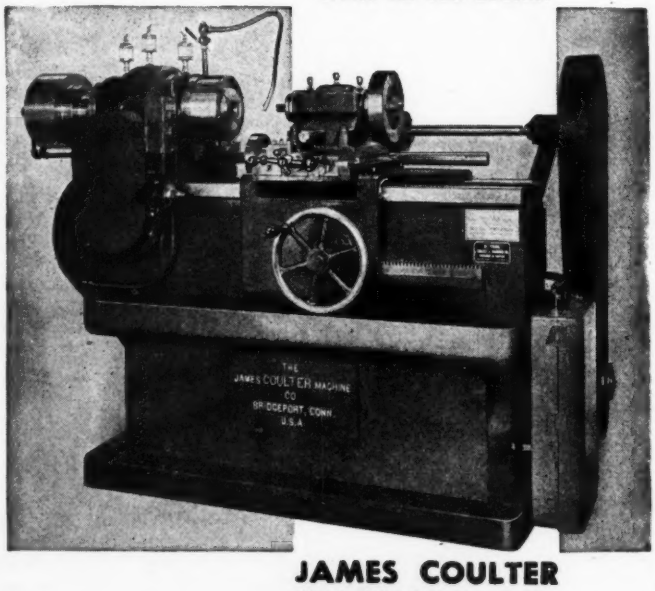
Thread Production at Wartime Speed!

Thread production—internal or external, right or left hand—through automatic, cam-controlled action! In the Coulter Type H Hob Thread Miller work and cutter spindles are individually motor-driven, permitting high output on any type of work that can be chucked. Maximum external thread, 7"; minimum internal thread depends on size of hob. Write for full details.



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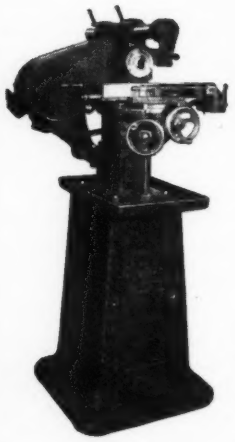

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Designed especially for the profitable handling of small and difficult work on a production basis. Burke Milling Machines are available in sizes Nos. 1, 2, 3, and 4, all motor driven.

Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

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We manufacture a complete line of rotary files and rotary rasps with a large stock of all sizes and shapes. We can supply any special size or shape desired.
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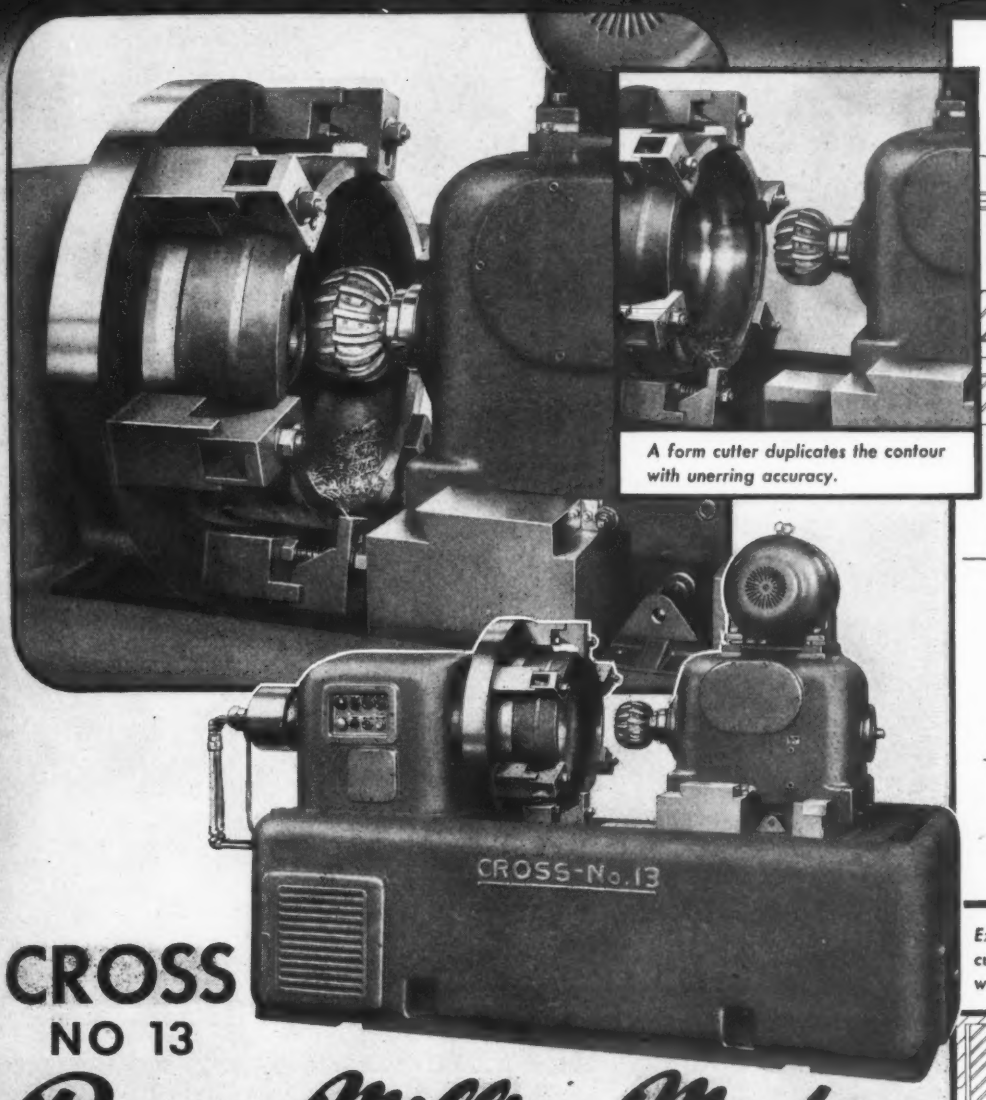
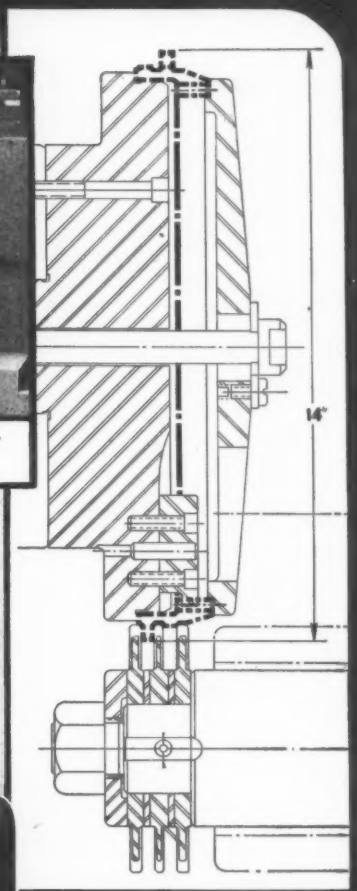


A form cutter duplicates the contour with unerring accuracy.



External operations with interrupted cuts are finished to close tolerances with the Cross Rotary Miller.

CROSS NO 13 *Rotary Milling Machine*

TOP ACCURACY—A GOOD FINISH—1/12 THE TIME is the story of machining Fluid Drive Housings with the Cross Rotary Miller. Automatic operating cycle with centralized push button control enables unskilled labor to achieve maximum results without scrap. Three models for small, medium and large work.

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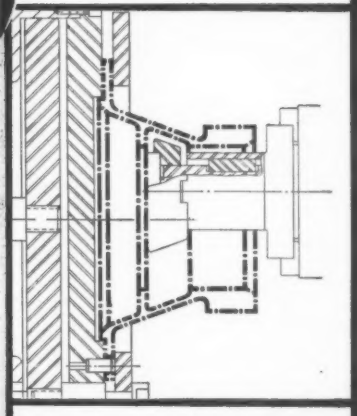

Irregular contours are processed in the usual way without special attachments or tooling.

CROSS GEAR & MACHINE CO.

Established in 1898

DETROIT, MICHIGAN, U.S.A.

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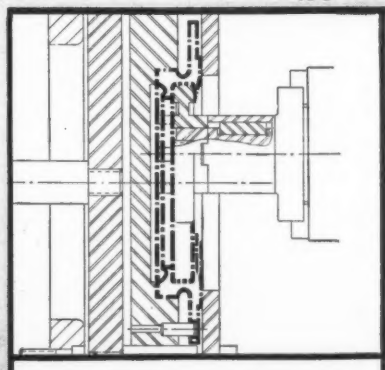
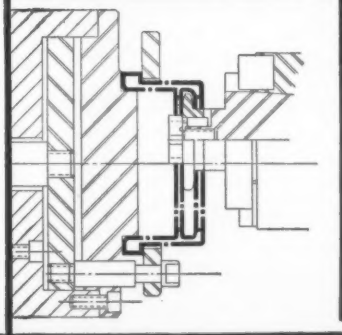
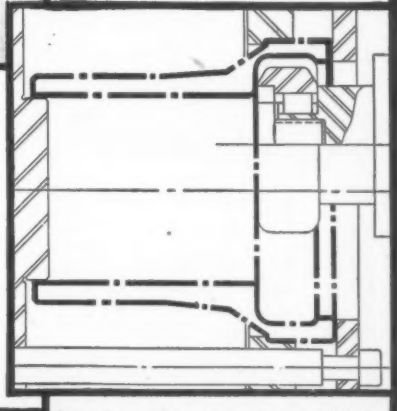


Rotary milling is an ideal method for handling many difficult operations on aircraft parts.

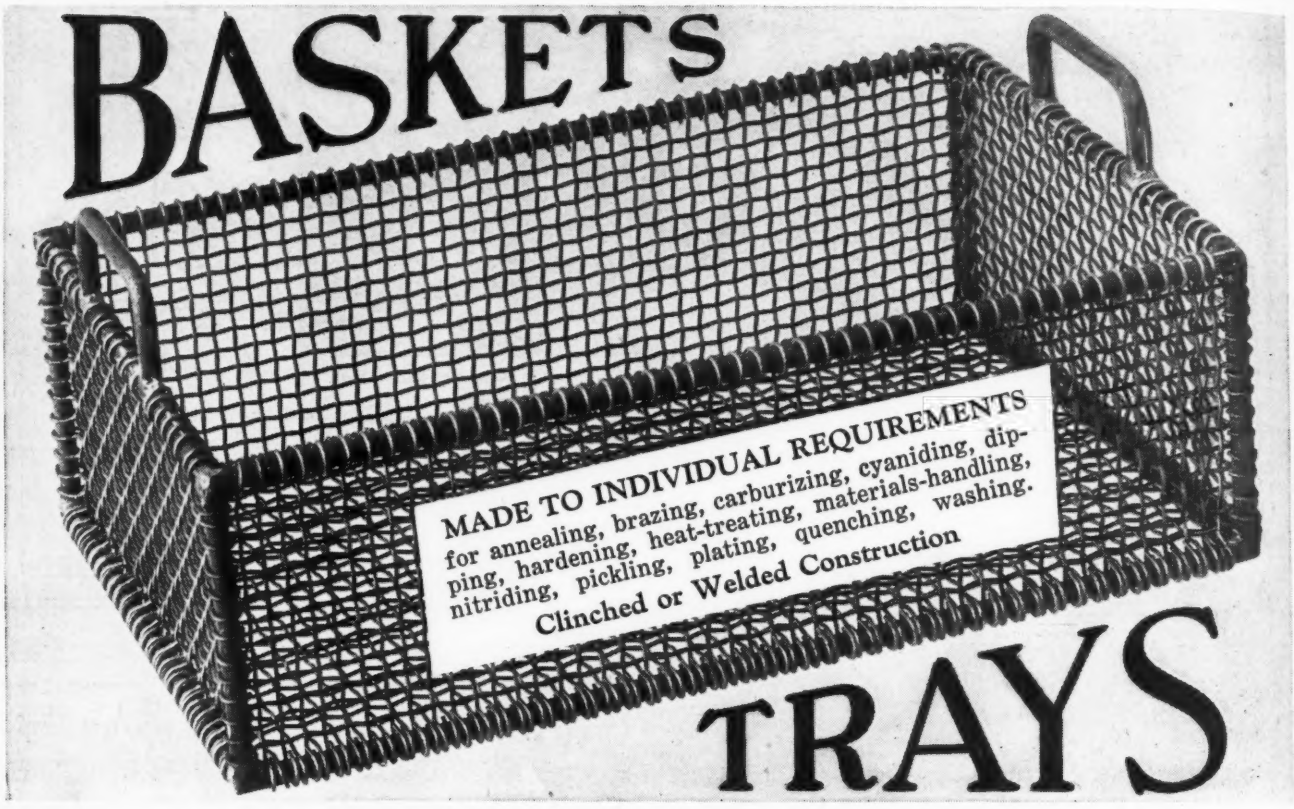


Multiple edge cutting tools with an enveloping cutting action satisfy the most exacting demands for fine finish.



Deep internal contours can be finished in one operation with the Cross Machine.

BASKETS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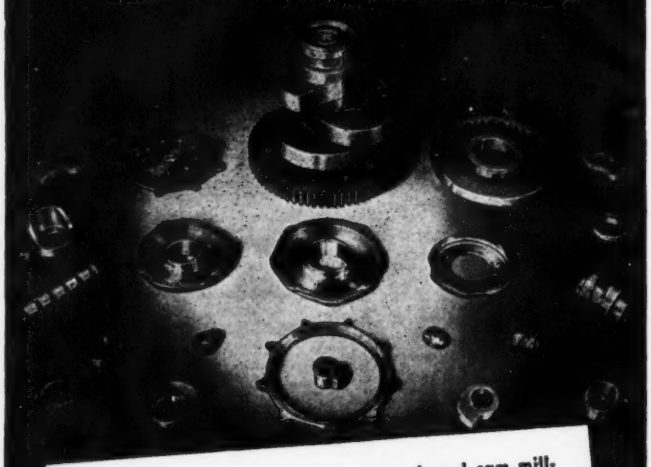

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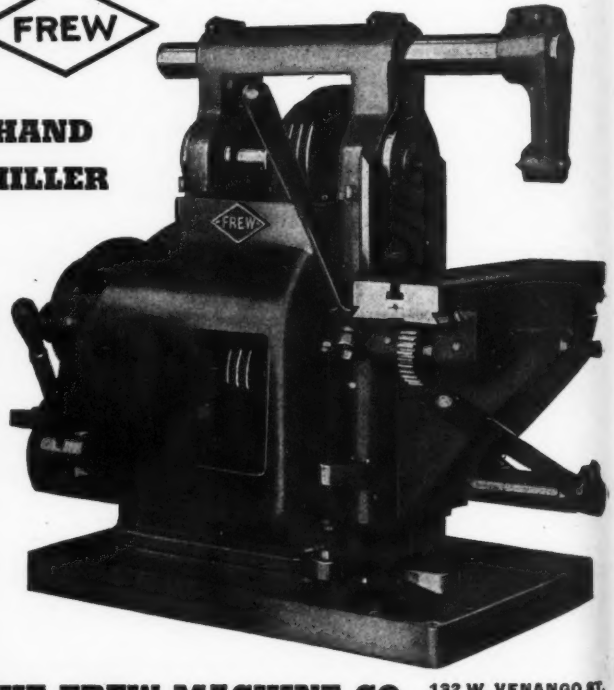

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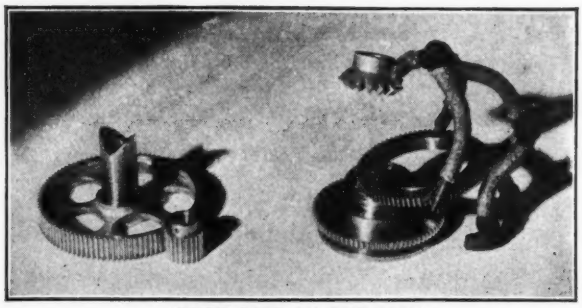

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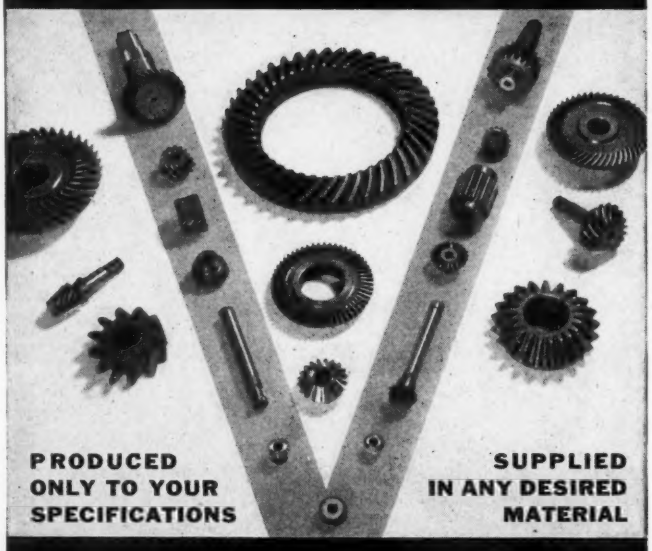

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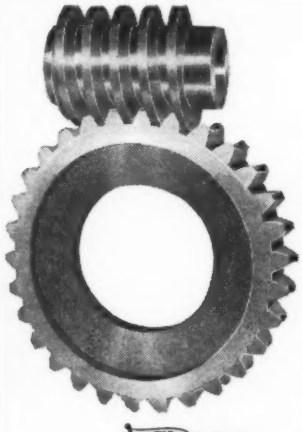

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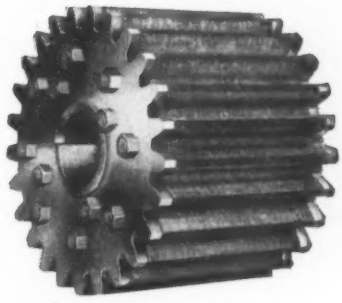

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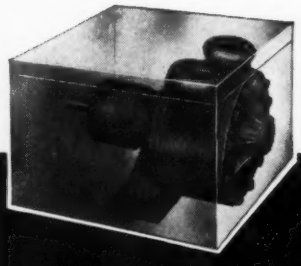

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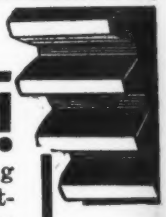

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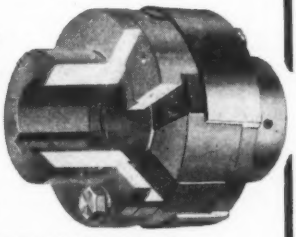

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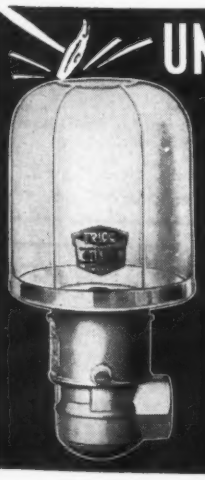

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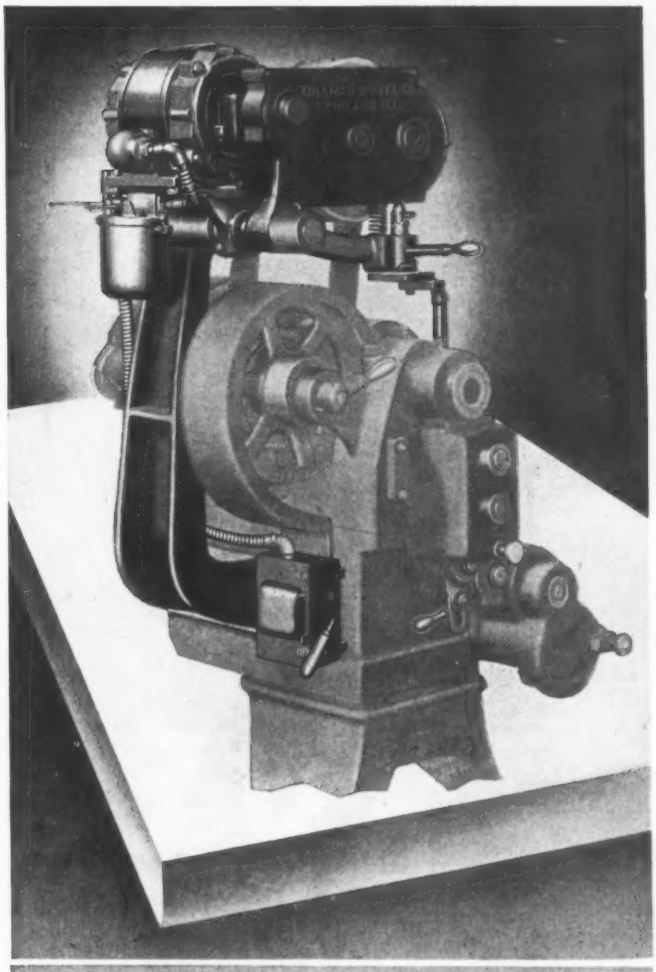

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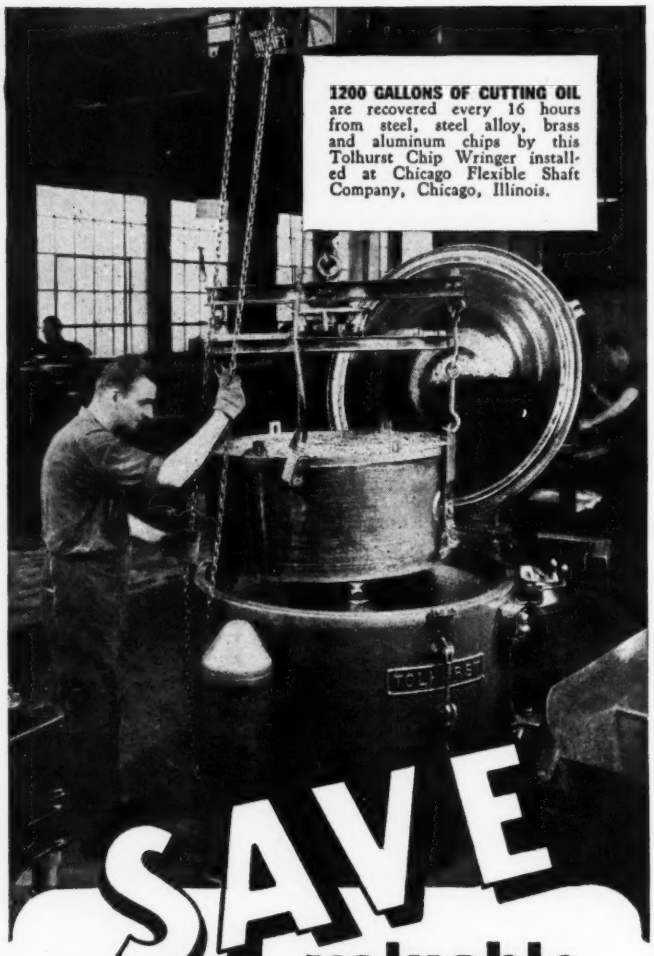
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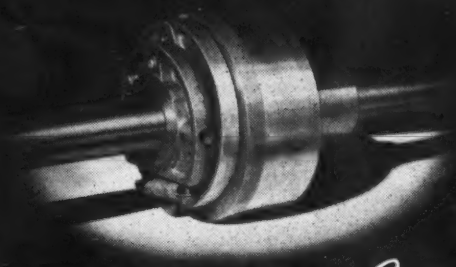

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- Fastest, simplest way to number parts.
- Easy—turn screw to change numbers.
- Made of best quality tool steel.
- Guaranteed for years of service.
- PROMPT DELIVERIES

STOCK TYPE
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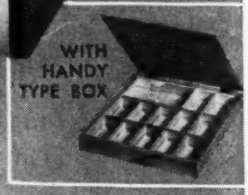
3.... BA 1864



SOSSNER

161 Grand St. New York 13, N. Y.

Walker MAGNETIC CHUCKS

10½" Double-Face Swiveling Magnetic Chuck. Radically new in design with central control. Sizes, 78" up to 206" in length.

- **The BEST way to Hold most work—**
- **The ONLY way to Hold some of it!**

Especially on intricate work, Walker Magnetic Chucks promote accuracy and reduce costs—for their application saves time, prevents distortion, often eliminates the need for costly and complicated clamps and work-holding fixtures. Equally efficient, fast and powerful on large, irregularly-shaped parts and on light, delicate work. All sizes, Rectangular, Swiveling and Rotary types; special chucks furnished for unusual applications. Also Belt- or Motor-driven DC and Portable AC Demagnetizers. Write for data.

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Atlas COOLANT PUMPS

NEW LOW PRICES $23.75 and up

Now equip every machine for higher production with a compact, portable Atlas Coolant Pump! Cuts tool wear, cuts finish rejections, lets operator concentrate full time on production. Two models, universal or induction motor, 450 and 225 GPH. Handle any cutting fluid, adjust from drip to stream. Immediate delivery! Send for complete information.

ATLAS PRESS COMPANY

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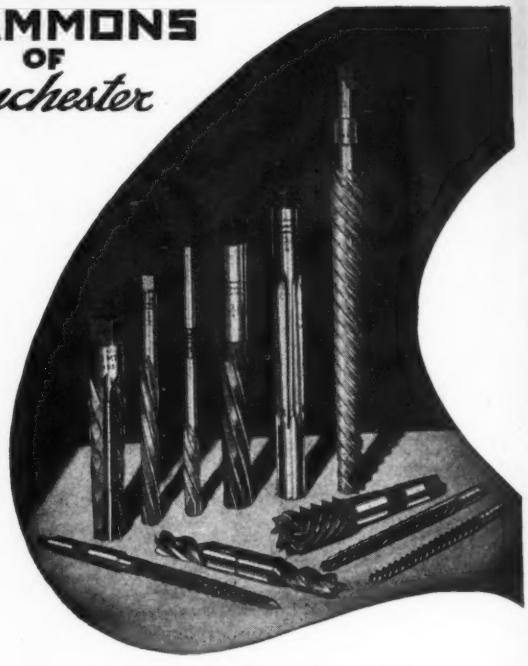
GAMMONS OF *Manchester*



PRODUCTION TOOLS

ORIGINATORS AND MANUFACTURERS OF HELICAL FLUTED TAPER PIN REAMERS

THE GAMMONS-HOAGLUND CO., MANCHESTER, CONN.

...Are you protecting Your Skilled Workers' EYES?

Many tool makers . . . die makers . . . master mechanics . . . expert lathe operators and other much-needed skilled workers could be helping the war effort and their former employers right now *if* it hadn't been for eye accidents—which could have easily been avoided.

There is an indisputable moral in this condition for those companies that have not yet lost key workers, even though failing to provide them with goggles: *don't continue to take chances with the law of averages —install an employee-protecting, money-saving goggle program* NOW!

American Optical Company offers you an entire line of comfortable goggles, each scientifically designed to meet specific types of eye hazards. Get in touch with your nearest AO Branch Office . . . or have an AO Safety Representative call.

American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS

"DIE-LESS" DUPLICATING

NO DIES!

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

"DIE-LESS" DUPLICATING might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines — Shears, Brakes, Benders — especially when used as a continuous, integrated production process.

The DI-ACRO System of METAL DUPLICATING WITHOUT DIES has proven its adaptability in making parts just as accurately as can be done with dies, to a tolerance of .001″ in all duplicated work. The delay of waiting for dies is avoided, deliveries speeded up. *Write for Catalog.*

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CRITERION *Boring Heads*

Original Accuracy *Maintained*

Lead Screw ground from Solid AFTER hardening.

Noted for maintaining original accuracy over a longer period Criterion Heads are smooth, compact, rigid. Parts subject to wear are hardened. Lead screw is hardened tool steel, with threads ground from solid after hardening. All heads have large, graduated dial. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½″ and 3″. ½″ and 1″ bar capacity. Shanks are interchangeable, enabling operator to use head on different machines. Ideally adapted for slide boring tool holder on small turret lathes. Ask your dealer or order direct. Request free literature.

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BEVERLY HILLS, CALIFORNIA

Free TRIAL IMMEDIATELY

on ZAGAR COLLET FIXTURES

The Production-Increasing Tools for milling, drilling, tapping, slotting and like operations

Simplicity of operation, accuracy, rugged construction and simple design assure greater and more accurate production by less experienced operators. We will ship to any reputable concern on a free 30-day trial. "No convince, no pay." Fair enough? Order today.

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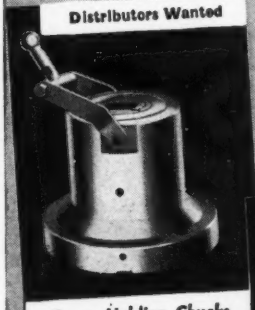

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Zagar Indexing Chucks come in 1″ and 2″ sizes.

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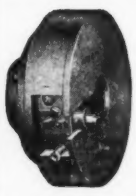
No Scoring! No Overheating!

Production and accuracy go up when scoring and overheating are eliminated. The Madison floating cutter compensates for misalignment and Madison design insures freedom from distortion due to overheating.

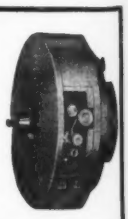
Use them for all work from ⅝″ up and get accuracy to .00025″.

MADISON
Manufacturing Co.
Muskegon, Mich.

FACE WHILE BORING



M-D Facing Head can be attached to Column Boring Mill Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically. 10 sizes, 6″ to 46″ dia. Write for descriptive bulletin and prices.



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LUERS

PATENTED CUTTING OFF TOOL HOLDERS
PATENTED CUTTING OFF BLADES

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

Manufactured by
J. MILTON LUERS, 12 Pine Street, Mt. Clemens, Mich.
Produced under License Issued by John Milton Luers Patents Inc.

DOWN-TIME IS LOST FOREVER...

Cal-Cutters stay on the job!

TIME taken for tool sharpening—time out for cutter replacements is *TIME lost forever!* Cal-Cutters *stay on the job* because they're heavily tipped with solidly supported tungsten carbides. They're fast cutting, high production tools that successfully mill *steel* as well as light alloys when used at proper speeds and feeds.

Standard end mills, shell end mills, face mills, staggered tooth mills, slitting saws, etc., are regularly made, as well as many *special* tools.

If you have a milling problem on steel, aluminum or dural castings and forgings or other metals take advantage of Cal-Cutter engineering to gain higher output, smoother surfaces and lower cost per piece! Quotations gladly furnished on all cutters without obligation. Write for Catalog 381-Y

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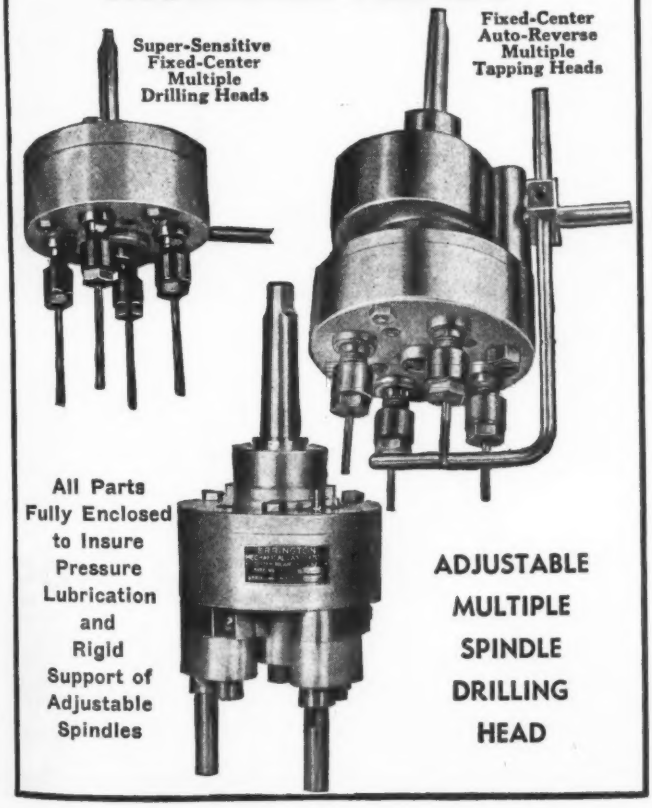
1915 EAST 51st STREET • LOS ANGELES 11 CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

ERRINGTON
STAPLETON, STATEN ISLAND, N. Y.
MULTIPLE HEADS

Super-Sensitive Fixed-Center Multiple Drilling Heads

Fixed-Center Auto-Reverse Multiple Tapping Heads



All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

NO WIRES—NO HEATING—NO OPERATING COSTS

Permanent Magnet Type Chucks are ready for instant use and on any machine of suitable size—no electrical connections of any kind are needed—chucks have strong holding power. Send for complete catalog.

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RECTANGULAR MODELS
5" x 10"
6" x 18"
8" x 24"
12" x 36"
ROTARY MODEL
9" Diam.

DELIVERIES ARE GOOD ON SOME SIZES
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BROWN & SHARPE
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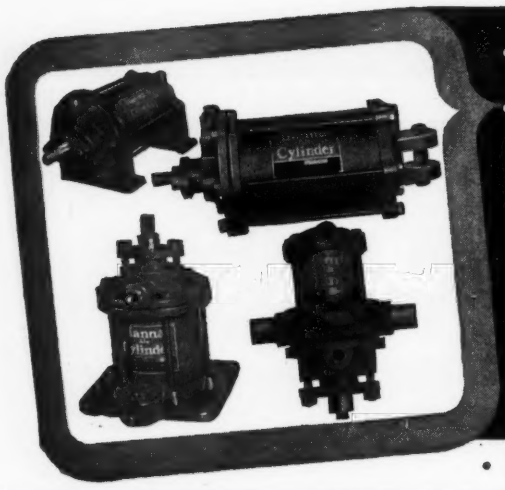
PERMANENT MAGNET TYPE



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• Use them to save time, labor and money in the plant and on machines. Wherever pushing, pulling or lifting is needed use safe, smooth, dependable power of Hanna Cylinders. You will find a standard model for your problem.

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HANNA ENGINEERING WORKS
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SPECIFY Precision LATHE ATTACHMENTS

IMMEDIATE DELIVERY FROM STOCK

For 10" Atlas & Logan, 9" South Bend ½" Capacity Lathes, etc.

Order from your dealer or write us for literature.

SpeediChuk with the **Precision BREN COLLET**

- Increases ½" collet capacity lathes to ¾".
- Ready for instant use and interchangeable on any 1½" x 8 thread spindle lathe . . . Atlas, Logan, 9" South Bend, Clausing, etc.
- Full Spindle Accuracy.
- LEVER TYPE for continuous production. Feather pressure releases work while lathe is running. LIST $79.50, Collet extra.
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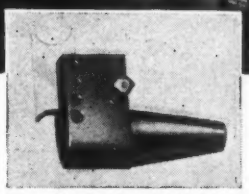
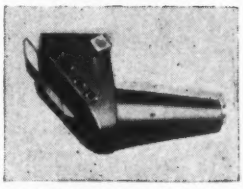
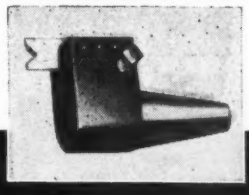
GENERAL DIE-STAMPING-TOOL COMPANY
PRECISION COLLET DIVISION 265 Canal Street, New York 13, N.Y.

K-J Quick Change LATHE TOOLS







THESE tools make possible change to any kind of operation without the use of wrenches after set-up is determined. Fine height adjustment of all tools is maintained, regardless of change of tools from one operation to another or from lathe to lathe. Instant positioning and accurate repeating assured. Tools changed in 3 seconds. Rigid Holder, with 50% less overhang, is perfect for cemented carbide cutters, prolongs all tool life. Write today for Bulletin "A"

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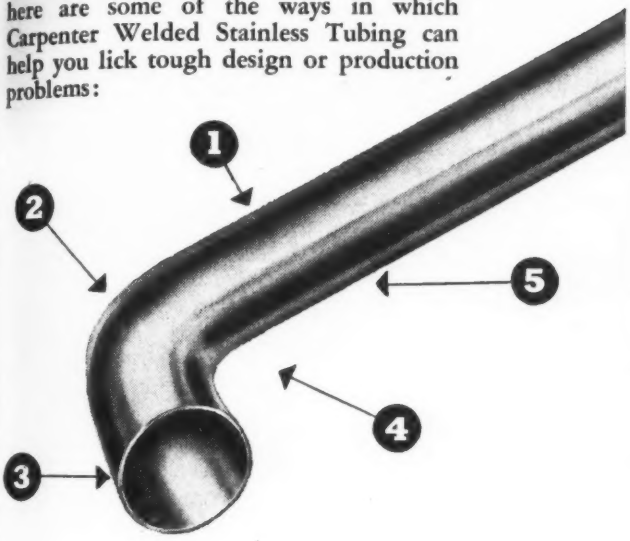
Thor STEEL STAMPS

Thor Stamps are made right. Characters are deeply cut, heads accurately turned and each stamp individually heat treated to the exact degree of toughness and hardness that gives the longest service — the most marks per dollar. Look for the name THOR and the BLUE HEAD on every stamp you buy.

THE PITTSBURGH STAMP COMPANY 810 Canal St., Pittsburgh, Pa.

How these Uniform Tube Walls help to Improve Products and Speed Production

Welded Stainless Tubing . . . with uniform walls . . . was pioneered by Carpenter. And here are some of the ways in which Carpenter Welded Stainless Tubing can help you lick tough design or production problems:



1 **LIGHTER GAUGES** can be used without sacrificing strength.

2 **EASIER BENDING,** flanging, cutting, welding, etc. with uniform walls.

3 **NO "THIN SPOTS"** to give corrosion or heat scale a foothold.

4 **WEIGHT IS SAVED** by using less metal to sustain a given weight or pressure.

5 **MORE COMPACT ASSEMBLIES** possible with strong and uniform walls in lighter gauges.

Take advantage of Carpenter's diversified experience with production-engineering problems involving the use of tubing. Drop a line to our Metallurgical Department when you need technical data—or when you could use fabricating help.

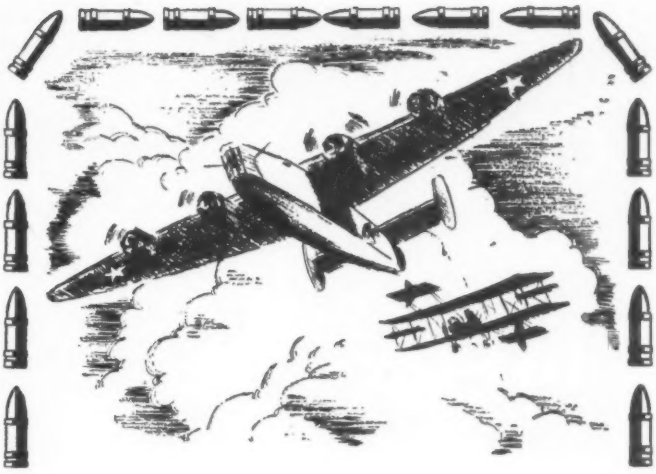
At Your Fingertips . . .

Here is useful information to help you get the most from Carpenter Welded Stainless Tubing. A note on your company letterhead will bring you this data on physical properties, diameters and gauges, special shapes, specialty tubing, etc. Ask for your free copy today.

The Carpenter Steel Company

Welded Alloy Tube Division • Kenilworth, N. J.

Carpenter
WELDED
STAINLESS TUBING



MARKING
ALSO HAS BEEN GREATLY IMPROVED

Almost unbelievable progress has been made in aviation when you compare the first flight at Kittyhawk with today's gigantic flight formations. Marking equipment, too, has made great forward strides. Keeping pace with stepped-up production, Noblewest engineering, painstaking research and long experience have developed machines to mark your products faster, better and at lower cost. Let us help you meet your present and future marking problems. Write for catalog supplement No. 43.

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Marking Specialists Since 1904

EAST HARTFORD, CONN.

Model 157
Combines the famed Noblewest rolling process with ease of operation, increased production speeds, sharper, clearer, permanent impressions.

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CONSERVE HIGH SPEED STEEL

Use Rogers Inserted Blade Reamers

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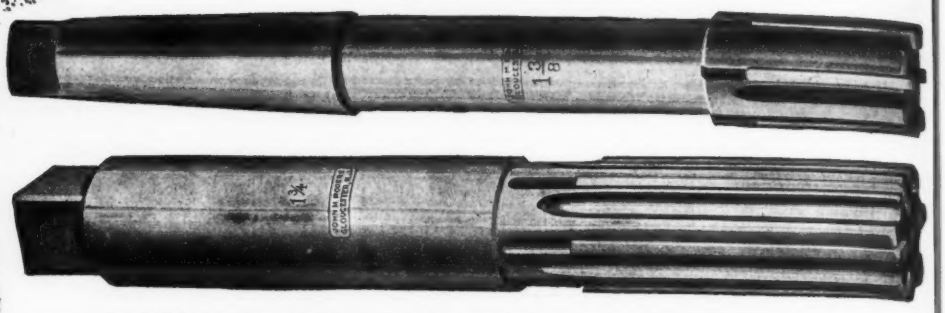
ROGERS REAMERS

SINCE 1885



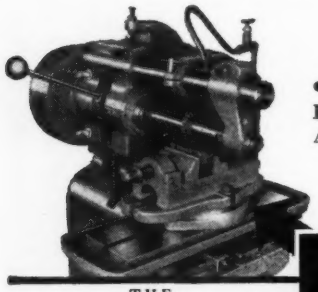
JOHN M. ROGERS TOOL CORP., Gloucester City, N. J.

PRODUCTO Machine Vises

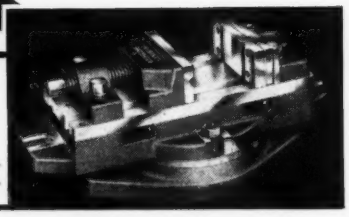
Everything in Machine Vises, from small 3" Drill Press Vise to 9" Heavy Milling Machine Vise . . . including hardened and ground Precision Tool Room and Jig Borer Vises; Plain, Swivel and Angle Vises in various sizes; Quick-acting Cam Lock Vises for production purposes.

All are of modern design and made for rugged wear and accuracy.

Ask for PRODUCTO bulletins on Modern Machine Vises and Shop Tools.



•Manufacturers of PRODUCTO Die Sets and Die Makers' Accessories.



THE **PRODUCTO** MACHINE COMPANY

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Alloy Steels for Offense

Scientifically selected to conserve critical alloys and meet the requirements of the AIRCRAFT, ORDNANCE, and MACHINE TOOL industries.

Complete "EARMARKED" stocks of Aircraft alloy steels at Buffalo and Detroit.

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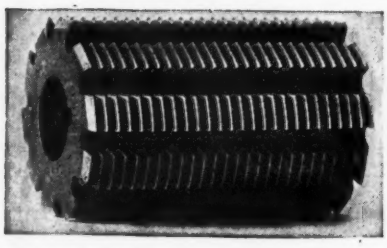


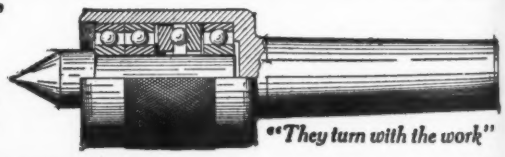
on Thread Milling Cutters, Combination Cutters and Circular Thread Chasers

Class 1, 2 or 3 fit, in any thread system and thread angle; shell cutters up to 7" O.D. and 5" width. Taper shank cutters to 12" overall length.

U. S. MACHINE TOOL MFG. CORPORATION

CLINTON, INDIANA PHONE 85

"ALIVE" Ball Bearing Centers



"They turn with the work"

MODERN MACHINE CORP., 323 Berry St., Brooklyn, N.Y.

Promptly made to your specifications—any size or style perforations, any metal, any gage or size sheet. Write us.

CHICAGO PERFORATING CO.
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This Tireless Watch-dog Prevents Motor Burnouts

The manufacturer builds it into motors ...and it's there for keeps... there to insure maximum capacity with safety at all times.

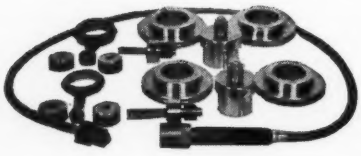
And the beauty of a built-in Klixon Protector is this ... it's a tireless watch-dog ...dependable at all times. It saves a motor's life over and over again. It clicks "off" every time a motor gets dangerously hot and then "on"... either automatically or by manual resist ...once the motor is cooled to safety.

Always insist on Klixon built-in Protectors with every motor you buy... A.C. all sizes and D.C. up to 30 volts. You'll cut out burnouts. You'll reduce work stoppage, repair costs and delays. You'll lengthen your motors' lives.

KLIXON CIRCUIT BREAKERS

SPENCER THERMOSTAT CO., ATTLEBORO, MASSACHUSETTS

A HOLE CHECKER *that operates by AIR*



The American Hole Checker is an outstanding development with many important advantages for precision production.

It utilizes a simple and efficient principle of air pressure and volume. Operates on air pressure as low as 50 lbs.

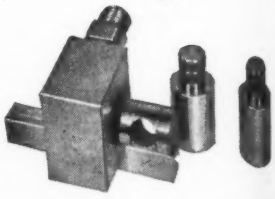
It is quickly set by using high and low limit master ring gages. Sizing plugs are specially designed and made of hardened steel, ground and precision lapped.

Simple and easy adjustment of high and low limits of tolerance on dial indicator. Can be calibrated to register .0001" or less.

Checks holes without actually contacting inside surfaces. Eliminates possibility of scratching or damaging soft or burnished hole surfaces.

Modern design, with all working parts enclosed. Flexible hose adaptor for checking work on fixed machines or where work is too heavy to handle.

All sizing plugs and adaptors made to suit your requirements. Send your prints or sketches for quotations. Prompt deliveries assured. Request Bulletin 43-MY.



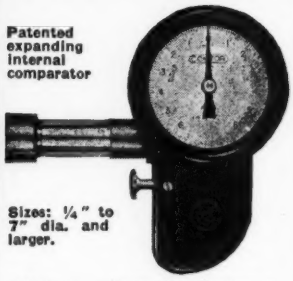
THE AMERICAN GAUGE CO.
125 Bayard St. DAYTON 1, OHIO

"We licked our toughest gaging problem with COMTORPLUG!"

Gives average worker ability to gage bores to fractions of .0001".

COMTORPLUG

Patented expanding internal comparator



Sizes: ¼" to 7" dia. and larger.

Unique automatic features of Comtorplug assure that relatively unskilled users will get accurate results, gaging precision bores to fractions of .0001". You can put this comparator in the hands of machine operators and bench inspectors, as well as supervising inspectors, and get surprising results in the way of improved quality starting right at the machine. Comtorplug checks size, as well as out-of-round, front or back taper, barrel shape, bell mouth, etc.

Request Bulletin 29

THE COMTOR CO.
74 Rumford Ave.
Waltham, Mass.

MODEL "AD-1" BARTELT PEDESTAL INDICATOR

MICROMETER HEAD ALSO AVAILABLE

A VERSATILE GAGE

The slide may be adjusted up and down on the pedestal and the dial indicator may be swung on the rod clamped in the slide, to indicate on any vertical, horizontal, or sloping surface. The vee base also has flat feet so it may be set firmly on a plane or cylindrical surface.

BARTELT PEDESTAL INDICATOR

Horizontal or vertical indicators can be supplied, reading to .001" or .0001" on smallest division as required. Three clamps are furnished for boring-tool setting, to fit shafts from 1" to 5" diameter, also an extension for the indicator rod. Bartelt gages are made of high quality material throughout, accurately machined to give long and reliable service.

Write for Circular

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"THE KEY TO *Precision in Production*"

FONDA *Gage* BLOCKS

A new technique is applied to FONDA GAGE BLOCK manufacture throughout all operations—from the selection of raw stock, through grinding, heat treating, stabilizing, finish grinding, the final precision machine lapping—Long-lived precision is literally built in. The "ULTRA FINISHING" process, developed by Fonda engineers, is the greatest factor in prolonging FONDA GAGE BLOCK life. Available through your local dealer in three degrees of accuracy of .000002", .000004" and .000008". Write to Dept. H for descriptive literature.

PASS HIGHEST TESTS DEVISED BY NATIONAL BUREAU OF STANDARDS

FONDA GAGE CO., 175 Fifth Ave., New York 10, N.Y. – Factory: Stamford, Conn.

THE CENTRAL *Certified Accuracy* Mmicrometer

Immediate Delivery

All sizes from one inch to six inches available for immediate delivery from stock.

Central *Certified Accuracy* Micrometers May Be Purchased singly or in de luxe sets. Write for illustrated catalog.

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MICROMETERS OF CERTIFIED ACCURACY

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CENTRAL
FOR MORE THAN A QUARTER CENTURY SPECIALISTS IN FINE MICROMETERS
CERTIFIED ACCURACY
THE CENTRAL Certified Accuracy MICROMETER
GUARANTEE
This micrometer is triple tested and is guaranteed accurate. If for any reason you are dissatisfied with this tool, return it with this guarantee within 30 days of purchase date to dealer from whom you purchased, and full purchase price will be refunded.
This guarantee, of course, is void in case of breakage, abuse, accident or other cause not inherent in the tool itself.
The Central Tool Co.
MICROMETERS OF CERTIFIED ACCURACY
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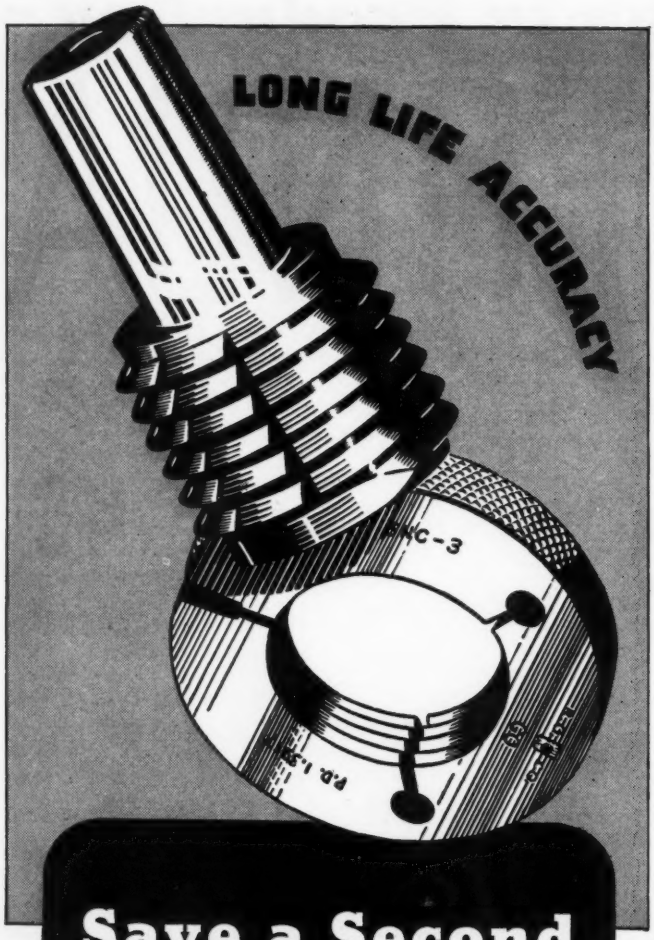
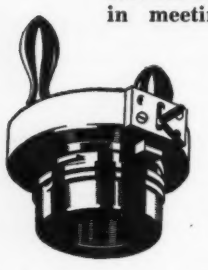
E
NAVY



Save a Second
Save a Life

The confidence that our gages are "right on the nose" will save seconds when your inspectors check your products. These seconds soon add up to vital hours saved in meeting your production schedule.



The extra long gaging life of our gages is achieved by using only the finest of tool steels, specially heat treated and skillfully ground. This extra wear life keeps our gages on your production line longer and reduces gaging costs to a minimum.

Our gages are guaranteed to meet all specified requirements.

Send to Dept. M for illustrated folder.

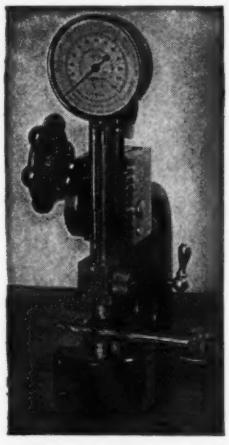
REPUBLIC GAGE
2228 FENKELL AVE. DETROIT 21, MICH.
PHONE UNiversity 1-0370

"ROCKWELL" HARDNESS TESTER

Shipment within a few days of these enormously improved new models.

383 Concord Ave., New York 54, N. Y.

WILSON
MECHANICAL INSTRUMENT CO. INC.



HARDNESS TESTING
Brinell—Shore—Scale

Included in our improved Portable Scleroscope Model D-1. This efficient single scale tester registers Brinell-Shore values without damage to the work. The old standby during the First World War is ready to serve again.

WRITE FOR CIRCULAR

THE SHORE INSTRUMENT & MANUFACTURING CO., INC.
9025 Van Wyck Ave., JAMAICA, N.Y.

MORGAN

Eliminate lost time handling raw materials, castings, work in progress, finished parts. Lift and carry with Morgan Cranes everywhere in the shop. Write for details, sizes, prices.

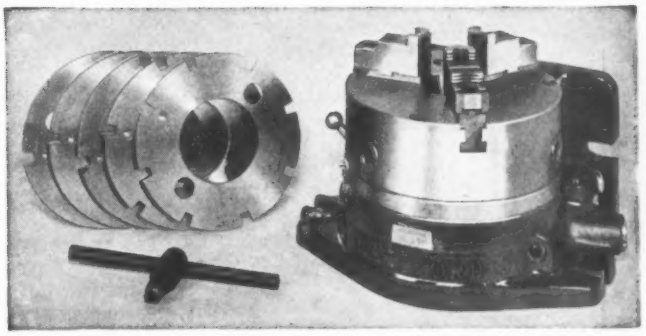
MORGAN ENGINEERING CO. Alliance, O.

CRANES

You can

SPEED

CHUCKING, INDEXING ON WAR PRODUCTION



• Above: SUPER-SPACER with standard equipment of mask plates, reversible jaw, self-centering chuck and sliding handle chuck wrench.

with the HARTFORD SUPER-SPACER

The SUPER-SPACER cuts chucking and indexing time on a wide variety of machining jobs—and eliminates errors in counting off! Use it for drilling (see illustration at left), also for milling, slotting, planing. Divisions of 2, 3, 4, 6, 8, 12 and 24 made quickly and surely without counting off. Odd spacings easily obtained through graduations of degrees on circumference of chuck. More rigid in operation than conventional dividing head; ruggedly built to withstand thrusts from any angle. Quickly mounted, horizontally or vertically, on any type of machine table. Efficient and profitable on both long and short runs. Write for bulletin illustrating HARTFORD SUPER-SPACER at work on actual jobs.

THE HARTFORD SPECIAL MACHINERY CO., HARTFORD CONN.

PROMPT DELIVERY

Precision Ground THREAD PLUG & RING GAUGES

Prove Your Product

American National Coarse Threads
American National Fine Threads
American National Special Threads
In Accordance to A.G.D.
Single End—Double End Plugs—Combination of a thread plug and plain plug for minor diameters
Split Adjustable or Solid Ring Gauges
Special Taps
(Catalogues Not Available)
Sizes of plugs up to 10" dia.
Sizes of rings from 1" to 8" I.D.

Attractive Offer for Representatives

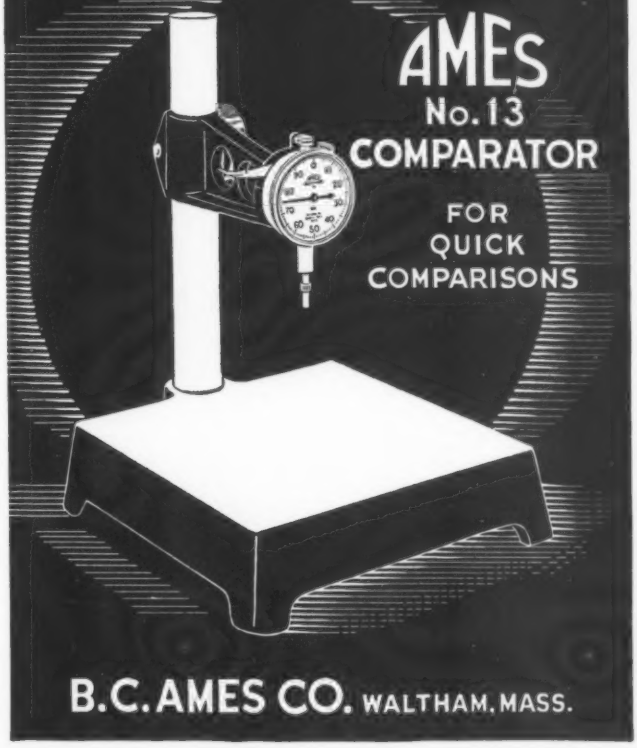
Send in Prints for Quotations

ALLEN GAUGE & TOOL CO.
421 N. Braddock Ave., Dept. X
PITTSBURGH, PA. (21)

FAST • ACCURATE

AMES No. 13 COMPARATOR

FOR QUICK COMPARISONS



B.C. AMES CO. WALTHAM, MASS.

"Boys, let's put our heads together and see how much paper and paper board we can save!"

THAT'S the spirit. That's what we've all got to do to lick this problem of getting enough paper and paper board for Army and war production use.

Every company has got to organize a Paper Conservation Committee and tackle the problem with all the gumption and the brain power at their command.

Paper inventories must be checked with the idea of eliminating peacetime extras. From stationery to board containers, every paper item must be examined to see in what way each company can use less paper.

Functional packaging must be the order of the day.

Sure, you have followed all the government directives on the subject. Even made cuts of your own. But, frankly, that isn't enough. Every time another ship leaves an American port loaded with paper-wrapped war supplies, the problem becomes tougher.

And it's up to you to join with the rest of industry to lick it. The war Advertising Council and the War Production Board have prepared a brief list of suggestions to help you. But you know your own business. You know how you can use less paper. ***It's up to YOU!***

To Get More Paper for . . .	*Use Less Paper These Ways*
Blueprints for battleships	Eliminate slack fills.
"K" ration containers	Increase units per case to the maximum practical.
Signal Corps radio sets	Reduce separators to shoulder height.
Containers for shells	Eliminate carton liners if possible.
Gas mask canisters	Eliminate individual cartons wherever possible.
Disposable gun covers	Reduce weight of containers whenever compatible with safety.
V-mail envelopes	Do away with all unnecessary overlapping.
Blood plasma boxes	Set up a Paper Conservation Board in your plant.

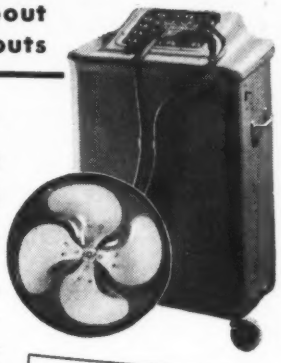
This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

Let's All Use Less Paper

Space contributed by MACHINERY

WELD 24 HOURS A DAY

And Don't Worry About Heat Stress or Burnouts



NEW ERGOLYTE A.C. ARC WELDER COOLED BY POWERFUL FAN

Here's an A.C. Arc Welder made to order for war welding. All the regular production-proved features *plus* cooling from a powerful built-in fan. Extra heavy insulation. No time out needed now for "cooling down". Write for information today.

FREE

POSTER FOR YOUR SHOP

Suggestions for better, faster, safer welding. Simply write in on your letterhead and say how many copies you can use.

ERGOLYTE MANUFACTURING COMPANY

3630 NORTH LAWRENCE STREET, PHILADELPHIA, PENNA.

TIME SAVER

The only wrench with all these features . . . instantly reversible ratchet . . . heads that fit two different size nuts . . . fits in narrow spaces . . . can be used over long studs. Try it! See why users report 75% faster nut tightening. Three handle sizes...each handle takes five different heads. Carried by leading supply houses.

GREENE, TWEED & CO.

Bronx Blvd. at 238th St., New York.

FAVORITE *Reversible Ratchet* WRENCH

ALWAYS FIRST CHOICE WITH MEN RESPONSIBLE FOR PRODUCTION

[5 SIZES for No. 0 to 5/8" drills]

Ettco-Emrick KEYLESS DRILL CHUCKS

Yes, men whose job it is to get stuff out, will prefer these chucks in the future, just as they have during the past 20 years, and just as they do today.

Why? Well, first and foremost, because these chucks ELIMINATE the KEY—and with it the waste of time and energy that goes with key-tightening. Drilling action does the tightening, and the heavier the load the tighter they hold. This assures a non-slip grip under all conditions. No damaged shanks and no retightening ever needed, even with women operators.

Secondly, because this valuable production-boosting advantage comes in drill chucks which are unexcelled for quality, precision, ruggedness and long life. There are none better made.

If you are not familiar with Ettco-Emrick KEYLESS Drill Chucks, get the facts now in BULLETIN No. 6. A copy will be mailed to you on request. WRITE TODAY.

ETTCO TOOL CO.

592 Johnson Ave., Brooklyn 6, N. Y.

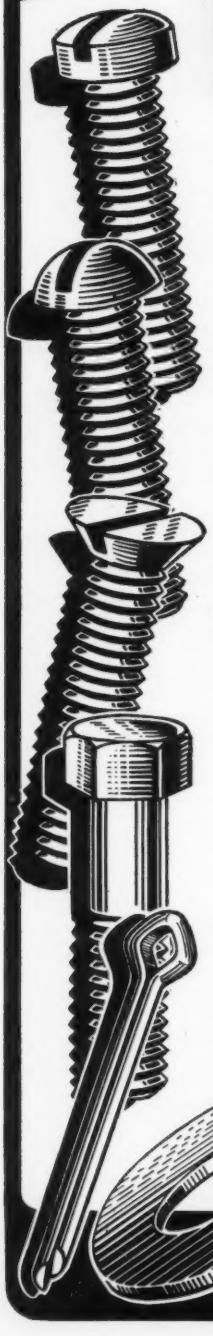
Detroit • Chicago

The Famous *Ettco-Emrick* DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

MAKE

STRONGHOLD SCREW PRODUCTS

A PART OF YOUR POST WAR PLANNING NOW!



IF your post-war production plans have reached the stage where you can anticipate your needs for screw products of definite types and sizes (or if you will let us help you in determining your post-war needs) you can protect yourself against delays in delivery by placing your requirements with us now for preferred handling when the restrictions on civilian production have been removed or relaxed. No priority is required.

Such orders are being accepted and held in file subject to current prices when definite delivery dates can be set.

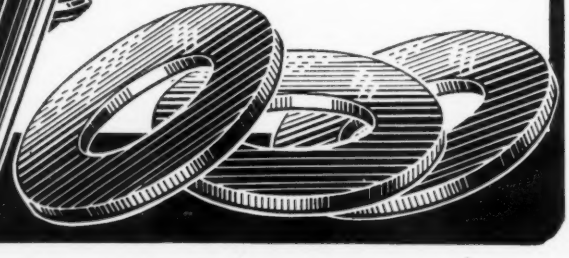
By ordering now you will be assured of prompt deliveries while others are still in the "blue-print" stage.

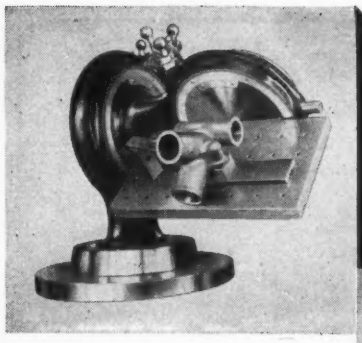
For your own protection—make "STRONGHOLD" a part of your post-war planning NOW!

A new STRONGHOLD catalog is in production. Is your name on our mailing list?

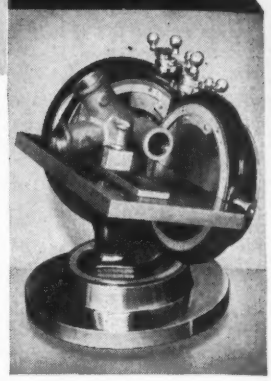
MANUFACTURERS SCREW PRODUCTS

209 W. Hubbard St., Chicago 10, Ill.





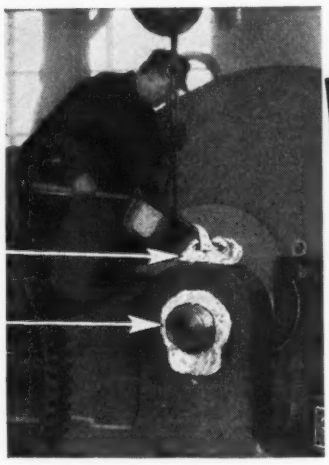
This Work CHECKED IN 15 MINUTES!



QUICK computation of angles and compound angles . . . **ACCURATE** to .001" or 1 minute of a degree . . . only **ONE SET-UP** of the work required! The Studler Angle Computer so simplifies layout of die work, survey of castings, and inspection of precision-machined parts that it does the work in one-half to one-tenth of the time required by the sine bar method. Simple to operate. Write today for Bulletin No. 2.

THE ANGLE COMPUTER COMPANY Dept. MA
5720 Melrose Avenue • Los Angeles 38, California

STUDLER ANGLE COMPUTER



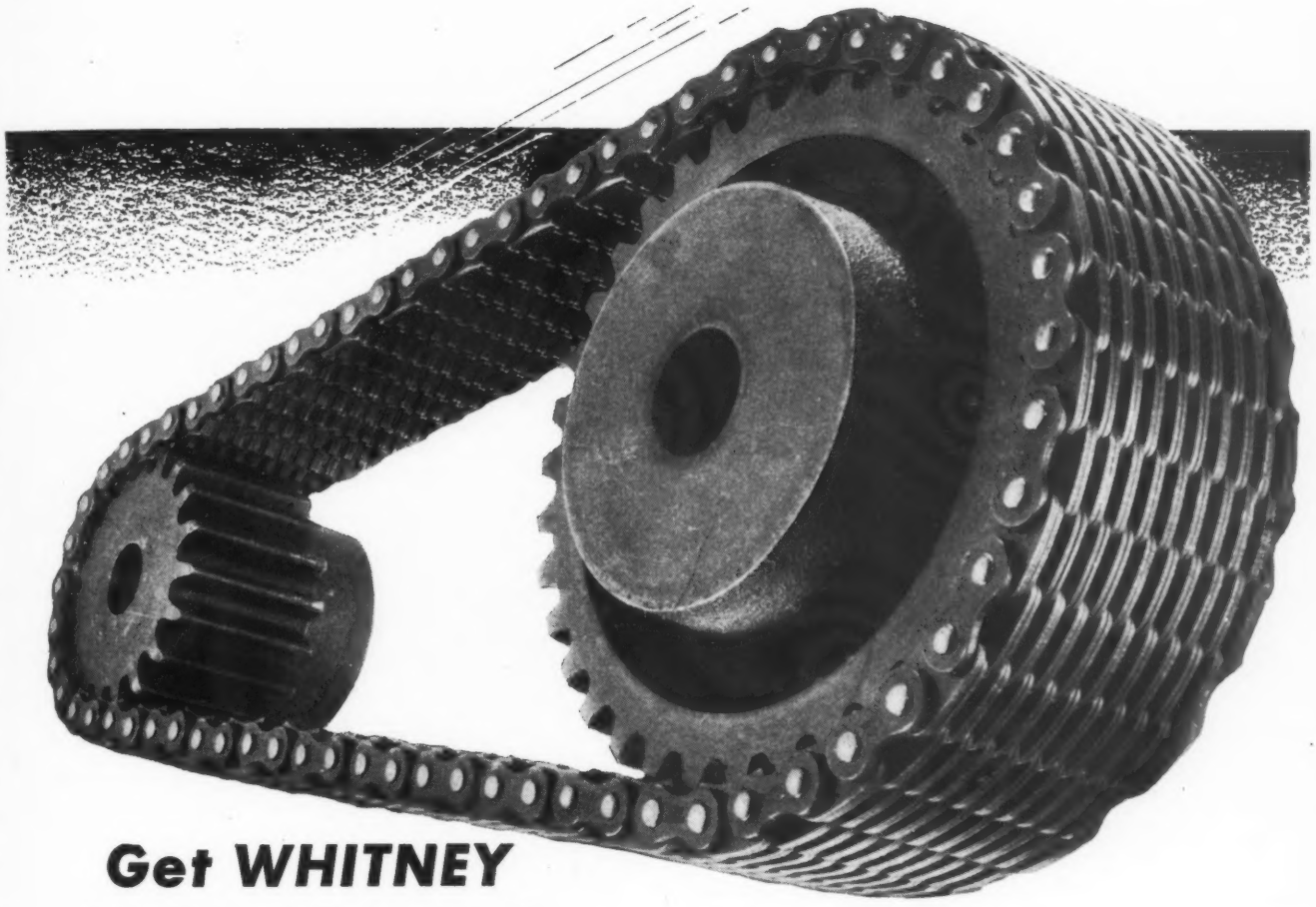
Babbitrite STICKS to the JOB!

Here is a babbitt retainer which has a 20-year record of *sticking to the job* under all working conditions. It is not affected by heat, is moisture-proof, will not melt, harden or dry out and speeds up babbitting operations. It provides absolute protection to workmen because it does not "blow out". Comes ready for use. May be re-used 100 times or more. *Write for a liberal sample.*

Babbitrite THE BABBITT RETAINER

PRODUCTS MFG. CO.
507 East Buffalo Street
MILWAUKEE 2, WISCONSIN

GET
MORE DRIVE
From Your Horsepower



Get WHITNEY SILENT CHAINS

You get more uniform, more consistent production when you equip your machines with Whitney Silent Chains. These sturdy, double-bearing chains cut friction loss down to a minimum . . . won't slip . . . and keep delivering *full power* to the job with no variation from set operating speed.

And today's fast operating speeds call for a rugged chain. That's why so many key war plants specify "Whitney". For Whitney alloy-armored steels give these chains a dependability you can count on for extra strength, extra service. A proven *toughness* you can rely on to withstand shocks and overloads during these long "duration" runs.

Give your war production machines this dependability. Make Whitney Silent Chains your drives for Victory.

THE WHITNEY CHAIN & MANUFACTURING COMPANY, HARTFORD 2, CONNECTICUT

Classified and Re-Sale Section

EASTERN OFFERS FROM STOCK

RADIAL DRILLS

2' American Triple Geared, M.D.
2½' Carlton Sensitive, gear box
3' American Triple Purpose, M.D. on arm, late type
3' American Hole Wizard, M.D. on arm, 18 spds. late type
3' American Sensitive, cone
3' Carlton Sensitive, cone
3' Cincinnati Bickford Plain, gear box on base
3' Fosdick Sensitive, gear box
3' Western Plain, gear box
3½' Cincinnati-Bickford Plain, U. S. Vari-Drive
3½' Cincinnati-Bickford Plain, var. speed d.c. motor
4' American Triple Purpose, 13" column, M.D. on base, late type
4' Cincinnati-Bickford Plain, M.D. on base
4' Cincinnati-Bickford Super-Service, M.D. on arm, 13" column, late type
4' Hammond Jack-Knife
4' Niles-Bement-Pond Semi-Universal, U. S. Vari-Drive on base
5' American Triple Geared, gear box on base
5' Cincinnati-Bickford Super-Service, 17" column, M.D. on arm, late.
5' Niles-Bement-Pond Full Universal, M.D. on base, universal table
5' Prentice Plain, U. S. Vari-Drive
6' Niles-Bement-Pond Semi-Universal, U. S. Vari-Drive
7' American Triple Purpose, M.D. on arm, 16" column

MULTIPLE SPINDLE DRILLS

No. 620H Natco Hydraulic, 16 spindles, No. 4 Taper, M.D., late
No. 2 Baush Hydraulic, 12 spindles, No. 2 Taper, M.D.
No. 2 Baush, mechanical, 8 spindles, M.D.
No. 2 Baush, M.D., tapper, 12 spindles
No. 3 Baush, M.D., 15 spindles
No. 11 Pratt & Whitney, 10 spindles
No. 22AC Fox, 16" round head, 6 spindles
No. 26C Fox Tapper, 50 spindles
3 spindles 12" Rockford Gang, M.D.
4 spindle Harrington H.D., No. 4 Taper

HORIZONTAL DRILLS

No. 00S Garvin Horizontal Duplex
Love Bros., No. 4 Taper
Pratt & Whitney Rifling Machine
5 spindle Detroit Semi-Automatic
6 spindle National Acme Horizontal
8 spindle Hammond, hydraulic feed

BROACHING MACHINES

NEW Cincinnati Mill Broach, circular type, 10" spindle dia., M.D.
No. 2 LaPointe of Hudson, belt
No. 3 J. N. LaPointe Double

BALL BEARING DRILLS

Providence Eng. Co. Model E, 7" overhang
No. 5M—16" Fosdick, motor on spindle
Automatic Sens., M.D.
Taylor & Fenn, 6½" overhang
Henry & Wright Class K, 7" overhang
2 spindle Sigourney, 7½" overhang
3 spindle Barr, 7" overhang
4 spindle No. 2 Fosdick, P.F., 8" overhang
4 spindle Gardam, 7" overhang
4 spindle Kokomo, 12" overhang
6 spindle No. 3 Avey, 12" overhang

GEAR MACHINERY

No. 712 Fellows H.S. Gear Shaper, M.D.
No. 61, 615 Fellows Gear Shapers, M.D.
Cross Gear Tooth Rounder, M.D.
No. 3—26" Cincinnati Gear Cutter
No. 3—26" Brown & Sharpe
No. 3—36" Brown & Sharpe
No. 3 Heavy Brown & Sharpe
No. 4—36" Brown & Sharpe
No. 4—48" Brown & Sharpe
No. 6—60" Brown & Sharpe
No. 6—72" Brown & Sharpe
Gleason Spiral Bevel Gear Rougher
12" Ingle Gear Tooth Rounder
16" Gould & Eberhardt
18" Gleason Straight Tooth Bevel
30" Brainerd Spur & Bevel
48" Cleveland Hobber

VALVE SEAT GRINDER

Cincinnati Valve Seat Grinder, M.D., with motors, has diaphragm chuck, cap. ⅜" valve stems

UPRIGHT DRILLS

20" Cincinnati, M.D.
22" Aurora
24" Cincinnati-Bickford, M.D., tapping
22" Barnes All Geared Self-Oiling
24" Hoefer
24" Sibley, compound table
25" Superior
36" Prentice

More than 1,000 machines in stock. Let us quote.

THE EASTERN MACHINERY CO.
1006 TENNESSEE AVENUE, CINCINNATI, OHIO

CIMSCO
Rebuilt Machine Tools

LATHES

24"x12' Niles Cone Head, Q.C.
26"x14' Putnam Cone Head, Q.C.
36"x30' LeBlond Geared Head, Q.C.

PLANERS

72"x60"x28' Pond Planer, Two Heads, Belt Drive
28"x28"x8' Woodward & Powell
24"x24"x6' Gray Planer
42"x42"x20' Cincinnati Hypro Planer, 4 hds.

GEAR CUTTERS AND HOBBERS

6" Bilgram Bevel Gear Generator
18" Gleason Bevel Gear Generator
1—No. 4, 36 Brown & Sharpe Gear Cutter

GRINDERS

Fitchburg Spline Grinder
Lees Bradner Gear Grinder
Simplicity Piston Grinder

MILLING MACHINES

No. 4 Cincinnati Vertical H.P. Miller, M.D.
No. 3GH LeBlond Planer, S.P.D.
6"x90" Pratt & Whitney Thread Miller

RADIAL DRILLS

2½' American, M.D.
3' American Sensitive
3' American, Plain
3' Cincinnati Bickford, Plain
4' Carlton Plain, M.D.
5' Cincinnati Bickford Plain, 86" under spindle
6' American Triple Purpose, M.D.

MISCELLANEOUS

14" Niles Slotter, Cone Drive
1500 lb. Bell Steam Hammer
Robinson Double Action Press

If machines you need are not listed above, send us your inquiry. We have a very large stock.

Cincinnati Machinery & Supply Co.
217 E. Second St., Cincinnati, Ohio

WANTED
A Product to Manufacture

Organization of several hundred skilled designers, engineers, and toolmakers, and a modern tool room seeks post war product or machine to tool. Complete facilities for development from tooling to sales and advertising. Box 964, MACHINERY, 148 Lafayette St., New York 13, N. Y.

LANDIS NO. 3½ INTERNAL HYDRAULIC RACE GRINDER
LATE T TYPE
Other High Grade Machines Available
SEND US YOUR INQUIRY
MOREY MACHINERY CO., Inc.
410 BROOME ST., NEW YORK

AVAILABLE—Manufacturing Representative having wide experience and extensive following in Northern and Southern California, Arizona and Nevada, would like to contact machine tool and allied supply manufacturers desirous of obtaining specialized and energetic representation in this area. Box 965, MACHINERY, 148 Lafayette St., New York 13, N. Y.

ALWAYS A SOURCE OF SUPPLY

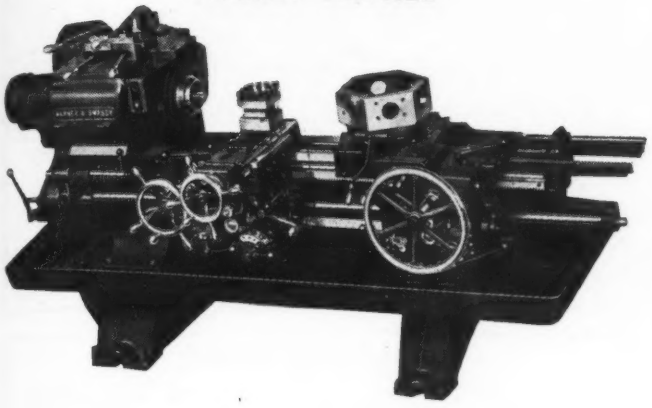
For Machine Tools, Stamping Presses, Structural Machinery, Forging Equipment, Hydraulic Equipment, Air Compressors, Production Equipment.

OUR SERVICES ARE ALWAYS AT YOUR DISPOSAL

EMERMAN MACHINERY CORP. 875 W. 120th ST., CHICAGO 43, ILL.

QUICK DELIVERY

TURRET LATHES



No. 4 WARNER SWASEY Gd. Hd., Universal, Timken Bearing, Motor Drive

3—21" GISHOLTS.

11—JONES & LAMSON Gd. Hd., AC Motor Drive. Sizes: 2¼"x24" and 3"x24"; 1 Double Head Machine.

4—No. 6-A POTTER & JOHNSTONS.

No. 2 W. & S., Wire Feed.

No. 4 W. & S., Wire Feed.

No 3 B. & O., Wire Feed.

28" NILES BEMENT POND, Gd. Hd., 4½" Hole.

No. 16 GISHOLT SIMPLIMATICS, 21" and 23" Swing.

SCREW MACHINES

2⅝" GRIDLEY Model G—4 Spindle.
2⅝" GRIDLEY Model G—4 Spindle.
2½" CONE—4 Spindle.
4" Model B NATIONAL ACME—4 Spindle.
2¼" NATIONAL ACME—4 Spindle.
1¾" GRIDLEY Model F—4 Spindle.
1¾" GRIDLEY Model F—4 Spindle.
1¾" GRIDLEY Model F—4 Spindle.
1⅝"x7" NEW BRITAIN—6 Spindle.
⅞" CONE—4 Spindle.
⅞" ACME GRIDLEY Model G—4 Spindle.
⅞" CONE—4 Spindle.
⅞" GRIDLEY Model G—4 Spindle.
⅞" GRIDLEY Model G—4 Spindle.
⅞" GRIDLEY Model G—4 Spindle.
¾" GRIDLEY Model F—4 Spindle.
2⅛" GRIDLEY—1 Spindle (2).
No. 55 NATIONAL ACMES.
No. 652 NEW BRITAIN CHUCKER.
Nos. 2 and 3 MANVILLE WOOD SCREW MACHINES.

HORIZONTAL BORING MILLS

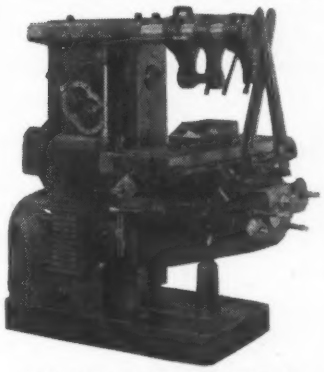
PRAC. NEW GIDDINGS LEWIS No. S60-T, Table Type, 6" Bar, 2½" Aux. Spindle, 60"x140" Table.
8" NILES-BEMENT-POND, Floor Type, Extra High Column, all geared feeds, motor drive with motor.
No. 43 LUCAS, 5" Bar, Table Type, 48" x 72" Table, M.D. (2).
6" GIDDINGS LEWIS, Table Type, New, 1941.
5" DETRICK HARVEY, Floor Type, M.D. No. 6 M.T.
3½" No. 32 GIDDINGS LEWIS, M.D., 36"x54" Table.
⅜ No. 0 GIDDINGS LEWIS, Table Type; 2½" CLEVELAND.
4" KEMPSMITH, Floor Type, 42"x60" Table, Motor Drive.
3" LUCAS, M.D.; 3" Bar MORRIS, Table Type. 3" PUTNAM.
3½" BEAMAN & SMITH; Table Type; S.P.D. 3½" BARRETT.
SNYDER 2-Way Horiz. Boring, Reaming and Drilling Machine.
FOOTE-BURT 2-Way Drilling and Boring Machine.

VERTICAL BORING MILLS

10 Ft. POND, 7 Chuck Jaws, P.F. Motor Drive.
3—72" COLBURN, Geared Feeds, Rapid Traverse, 4 Chuck Jaws, 1 with 2 Rail Heads, 1 with 2 Swivel Heads.
60" COLBURN, Gd. Feeds, M.D., 1 Swivel Hd., Rapid Traverse, 1 Turret Head.
53" N.B.P. 51" BULLARD; 2 heads on rail; 50" table.
48" COLBURN, 1 Swivel Head, 1 Turret Head Rapid Trav., M.D.
42" GISHOLT, Rapid Traverse.
36" GISHOLT; 3 Chuck Jaws, 1 Turret Head on Rail, M.D.
48" ROCKFORD; 3 spindles, 48" rotary table.
4 Spindle ROCKFORD, 38" table.
6" BULLARD MULT-AU-MATIC, 4 Stations, Motor Drive. Serial Number Over 14,000. Excellent Condition.

MILLING MACHINES PLAIN

No. 2 CINCINNATI, Rect. Overarm; Rapid Traverse, Timken Bearing, Motor in Base, New, 1940.



No. 2-S K. & T. Double Overarm, Motor in Base.
No. 3 CINCINNATI, S.P.D., Hi-Power, Rapid Traverse.
Nos. 4 and 5 CINCINNATI, Rect. Overarm, Rapid Trav.
No. 2-B K. & T. Double Overarm, S.P.D.
No. 4 LeBLOND Heavy Duty.
Nos. 3 and 2 CINCINNATI.

UNIVERSAL

No. 3 CINCINNATI, S.P.D.
No. 3 BROWN & SHARPE.
No. 1½ HENDEY, NORTON and CINCINNATI.
Nos. 1 and 2 KEMPSMITH.

VERTICAL

No. 3 BROWN & SHARPE.
No. 5-B BECKER. No. 2 B&S.
No. 2½B KEARNEY-TRECKER.

MILLS—PLANER TYPE AND SLAB

44"x40"x10' INGERSOLL Planer Type; Adjustable rail; 4 hds.
42"x42"x13' INGERSOLL Slab; 1 vertical head, M.D.
42"x42"x12' INGERSOLL Planer Type; 2 side heads; 1 vertical head.
42"x36"x6' BEAMAN & SMITH Openside Planer Type; 1 vertical head, 1 side head. M.D.

PRODUCTION MILLS

OHIO, Type P, M.D., Table 16"x72", Timken Bearing Spindle, New 1941.
24" and 18" CINCINNATI Automatics, M.D.
10" PRATT & WHITNEY Semi-Automatic.
No. 45 PRODUCTOMATIC.
BILTON CAM MILL.
2" PRATT & WHITNEY Duplex Spline Mill.

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2—PRACTICALLY NEW ZEPHYR MODEL M-1 CENTERLESS GRINDERS, Grinding Wheel and Feed Wheel with Motors, Coolant Pump and Tank.
No. 2 CINCINNATI CENTERLESS, M.D.

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No. 72 HEALD Sizematic Internal, Hydr. Feed, M.D.
No. 52 GREENFIELD Hydroil Internal, Hydr. Feed, Ball Bearing Spindle (2).
No. 70 HEALD INTERNAL. No. 60 HEALD.

SURFACE

No. 16A BLANCHARD Automatic Rotary Surface, 30" Magnetic Chuck, 18" Grinding Wheel, M.D.
No. 16 BLANCHARD, 26" Mag. Chuck, M.D.
15"x15"x96" NORTON, 2 Mag. Chucks, Oil Pump.
No. 3 ABRASIVE, M.D., Magnetic Chuck.
No. 2 WILMARTH & MORMAN, M.D., Mag. Chuck.

CYLINDRICAL

14"x72" NORTON, 2"x16" Wheel, P.F.
No. 22 LANDIS, 12"x34", P.F., Pump and Pan.
10"x36" LANDIS; 3" LANDIS Ball Race.
6"x18" LANDIS PLAIN.
No. 1 LANDIS UNIVERSAL; BATH Universal.

DISC

No. 24 GARDNER, Vertical Spindle Horizontal, Ball Bearing, 53" disc.

TOOL AND CUTTER

No. 1 WILMARTH & MORMAN.
No. 1 LeBLONDE.

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60"x18' NILES, 2 Heads on Rail, Motor Drive.
44"x36"x12' GRAY, 2 Heads on Rail.
30"x8' WHITCOMB.
27"x5' NEW HAVEN.
36"x8' N.B.P., 2 heads on rail.

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No. 5 MITTS & MERRILL KEY-SEATER.
NEWTON KEYWAY MILLER.

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5 ft. and 4 ft. REED PRENTICE, M.D.
4 ft. RYERSON, 11" Column, S.P.D. No. 5 M.T.
4 ft. AMERICAN, No. 5 M.T., 11" Column.
3½ ft. FOSDICK, S.P.D.
3 ft. FOSDICK, No. 4 M.T., 10" Col.
2½ ft. GANG SENSITIVE, Cone Drive.

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No. 242 BARNES, M.D., 20" SNYDER.
36" PRENTICE, 36" SNYDER.
36" BAKER, Heavy Duty, No. 6 M.T., S.P.D.
24" BARNES, 20" SIBLEY.
20" COLBURN MFG., Geared Feed, No. 4 M.T.
2-Spindle FOOTE-BURT, Heavy Duty.
8-Spindle MULTIPLE, M.D., No. 5 M.T.

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16"x8' and 14"x6' AMERICAN Gd. Hd.
24"x12' LeBLONDE.
18"x10' HENDEY, Taper Attachment, M.D.
2—16"x6' PRATT & WHITNEY Gd. Hd.
14"x6' PRENTICE.
42"x18' NEW HAVEN, 10' Centers, Triple Gd.
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PIT LATHE, 86" swing.
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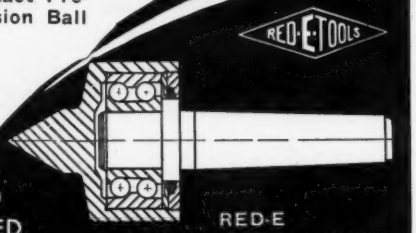

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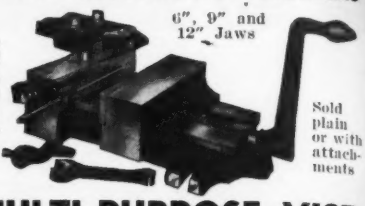

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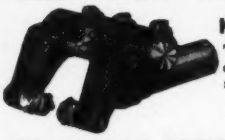

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GEAR HOB. No. 16 HS Gould & Eberhardt
GEAR CUTTER. 60"x16", No. 5A Cincinnati
GEAR SHAPER. No. Z1 Fellows
GRINDER. 12"x48", No. 3 Cincinnati, univ.
GRINDER. 12x36", 16x36", 16x52" Landis
GRINDER. Nos. 50 and 60 Heald cylinder
GRINDER. No. 72 Heald electric indicator automatic internal
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PRESS. No. 33 Consolidated, arch frame
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PRESS. No. 8-7 Zeh & Hahnemann, S.S.
PRESS. No. 2 Standard screw type
PRESS. 108", No. 796¼ D Toledo toggle
RIVETER. Nos. 5½B and 7B High Speed
ROLLS. No. 1 Ajax taper forging
SWAGER. No. 6 HS Langelier
SHAPER. 16" Milwaukee
SHAPER. 36" Morton draw cut
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No. 13-B B & S Prod. Miller
No. 3 Lapointe Broach
21-8A Cochrane-Bly H. S. Saw
No. 171 Bliss Stiles Sprue Cutter
12" Lamb & Nash Type K Slitter
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10"x120" Norton Grinder, M.D.
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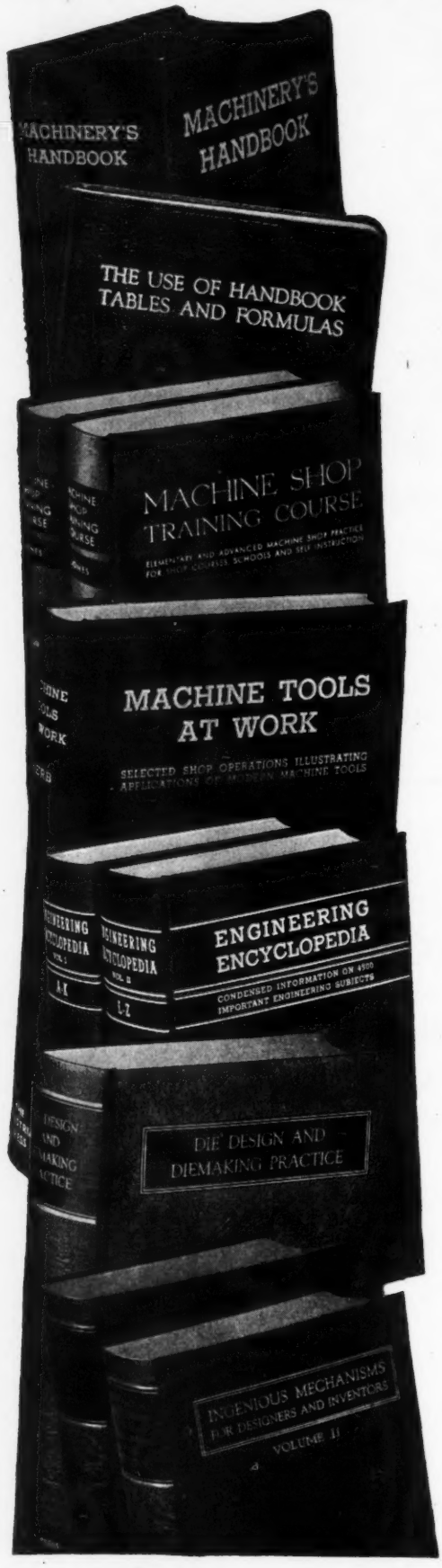
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For location of advertisements of manufacturers listed, see alphabetical index, pages 415-416

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Abrasive Products, Inc., South Braintree, Mass.
Carborundum Co., Niagara Falls, N. Y.
Walls Sales Corp., 96 Warren St., New York.

ABRASIVE DISCS
Abrasive Products, Inc., South Braintree, Mass.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Felker Mfg. Co., Torrance, Calif.

ABRASIVES, POLISHING
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

ACCUMULATORS, HYDRAULIC
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y. and Ansonia, Conn.
Farquhar, A. B., Co., Ltd., York, Pa.
Hydropress Co., Inc., 570 Lexington Ave., New York, N. Y.
Lake Erie Engineering Corp., Buffalo, N. Y.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., Philadelphia, Pa.

AIR HOISTS
See Hoists, Air.

AIR TOOLS
See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOY-STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEEL, TUNGSTEN, VANADIUM, MANGANESE
Republic Steel Corp., Cleveland, O.

ALLOYS, MAGNESIUM
Dow Chemical Co., Midland, Mich.

ALLOYS, NON-FERROUS
American Brass Co., Waterbury, Conn.

ALLOYS, ZINC
National Lead Co., 111 Broadway, N. Y.

ANGLE FIXTURE, COMPOUND
Angle Computer Co., Los Angeles 38, Cal.

ARBOR PRESSES
See Presses, Arbor.

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence.
Cleveland Twist Drill Co., Cleveland.
Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Davis Boring Tool Div., St. Louis, Mo.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Kempsmith Mch. Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland, O.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

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Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Bunting Brass & Bronze Co., Toledo, O.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

BABBITT RETAINERS
Products Mfg. Co., Milwaukee, Wis.

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Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Pope Machinery Corp., Haverhill, Mass.
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Hoover Ball & Bearing Co., Ann Arbor, Mich.
S K F Industries, Inc., Philadelphia, Pa.
Waterbury Steel Ball Co., Inc., Poughkeepsie, N. Y.

BARS, BORING
See Boring Bars.

BARS, PHOSPHOR BRONZE
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.

BARS, STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Follansbee Steel Corp., Pittsburgh, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Jessop Steel Co., Washington, Pa.
LaSalle Steel Co., P. O. Box 6800 A., Chicago.
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Timken Roller Bearing Co., Canton, O.
Union Drawn Steel Div., Massillon, Ohio.
Wheelock, Lovejoy & Co., Cambridge, Mass.

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Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
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S K F Industries, Inc., Philadelphia, Pa.
Torrington Co., Torrington, Conn.

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Bealy, Chas. H. & Co., 120-B N. Clinton St., Chicago.
Bunting Brass & Bronze Co., Toledo, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Haynes Stellite Co., Kokomo, Ind.
Johnson Bronze Co., New Castle, Pa.

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Fafnir Bearings Co., New Britain, Conn.
Hill Acme Co., Cleveland, O.
Hyatt Bearings Div., General Motors Sales Corp.; Harrison, N. J.
Link-Belt Co., Indianapolis 6, Ind.
Roller Bearing Co. of America, Trenton, N. J.
S K F Industries, Inc., Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, NEEDLE

Bantam Bearings Corp., South Bend, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roller Bearing Co. of America, Trenton, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, ROLLER

Ball & Roller Bearing Corp., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Link-Belt Co., Indianapolis 6, Ind.
McGill Manufacturing Co., Valparaiso, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roller Bearing Co. of America, Trenton, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia, Pa.
Timken Roller Bearing Co., Canton, O.

BEARINGS, SELF-LUBRICATING (OILLESS)

Arguto Oilless Bearing Co., Wayne Jct., Philadelphia.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, TAPERED ROLLER

Bantam Bearings Corp., South Bend, Ind.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Orange Roller Bearing Co., Inc., Orange, N. J.
Timken Roller Bearing Co., Canton, O.

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Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Bunting Brass & Bronze Co., Toledo, O.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
Hill Acme Co., Cleveland, O.
Link-Belt Co., Indianapolis 6, Ind.
McGill Manufacturing Co., Valparaiso, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
S K F Industries, Inc., Philadelphia, Pa.
Timken Roller Bearing Co., Canton, O.

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Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

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Ready Tool Co., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

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Link-Belt Co., Indianapolis 6, Ind.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.

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Hill Acme Co., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.

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Lake Erie Engineering Corp., Buffalo, N. Y.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., Philadelphia, Pa.

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Farquhar, A. B., Co., Ltd., York, Pa.
Watson-Stillman Co., Roselle, N. J.

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BLOWERS

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Ingersoll-Rand Co., 11 Broadway, New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

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National Tube Co. (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.

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Denison Engineering Co., Columbus, O.
Hill Acme Co., Cleveland, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
New Britain-Gridley Mch. Div., New Britain Machine Co., New Britain, Conn.
Oster Manufacturing Co., Cleveland, O.

BOLTS AND NUTS

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National Acme Co., Cleveland, O.

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Lincoln Electric Co., Cleveland, O.

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Barnes, W. F., & John, Co., Rockford, Ill.
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Foote-Burt Co., Cleveland, O.
Gorton, George, Mch. Co., Racine, Wis.
Jones Machine Tool Wks., Inc., Valley Forge, Pa.
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland, O.
Pedrick Tool & Mch. Co., Philadelphia, Pa.
Rogers Machine Works, Inc., Buffalo 7, N. Y.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.

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Jones Machine Tool Wks., Inc., Valley Forge, Pa.
King Machine Tool Co., Cincinnati, O.
Rogers Machine Works, Inc., Buffalo 7, N. Y.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.

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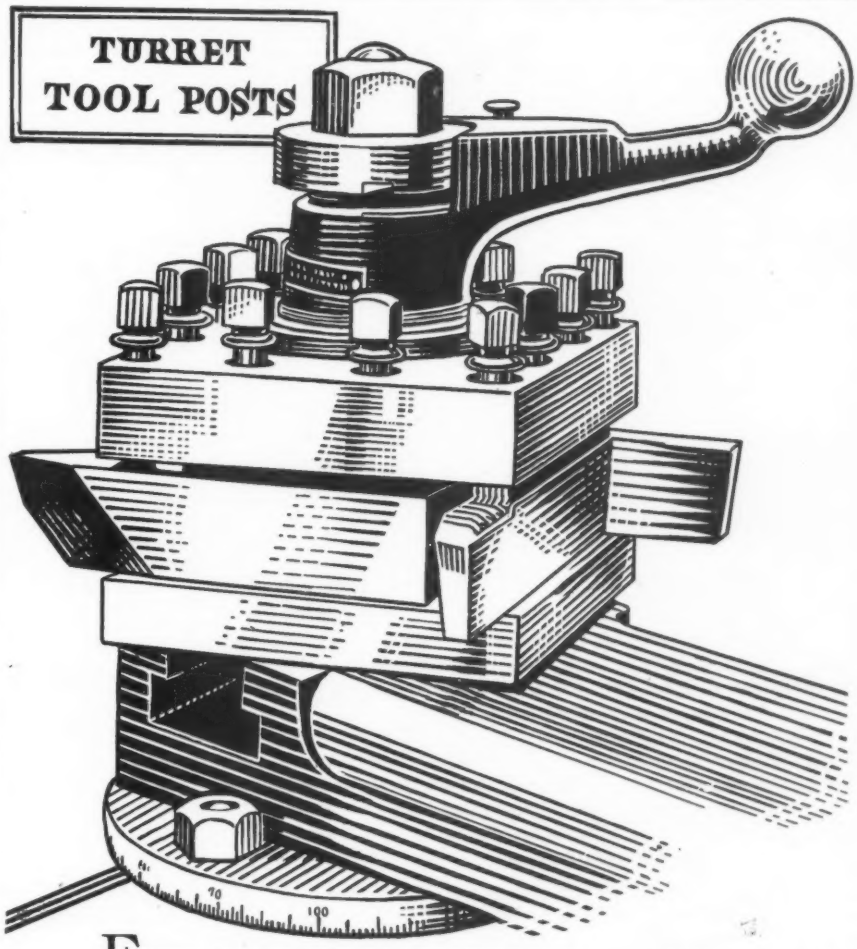
Carboloy Co., Inc., Detroit.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit, Mich.

TURRET TOOL POSTS



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Ready Tool Co., Bridgeport, Conn.
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Warner & Swasey Co., Cleveland, O.
Williams, J. H., & Co., 225 Lafayette St., New York.

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Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
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Lucas Mch. Tool Co., Cleveland, O.
Moline Tool Co., Moline, Ill.
Ohio Machine Tool Co., Kenton, O.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Sommer & Adams Co., Cleveland, O.
Universal Boring Machine Co., Hudson, Mass.

BORING HEADS

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Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corp., Detroit, Mich.
Gairing Tool Co., Detroit, Mich.
McCrosky Tool Corp., Meadville, Pa.

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Heald Machine Co., Worcester, Mass.
Stokerunit Corp., Milwaukee, Wis.

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Machinery Mfg. Co., Los Angeles, Calif.
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Reed-Prentice Corp., Worcester, Mass.

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Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit, Mich.
Gisholt Mch. Co., Madison, Wis.
Haynes Stellite Co., Kokomo, Ind.
Jones & Lamson Mch. Co., Springfield, Vt.
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McCrosky Tool Corp., Meadville, Pa.
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Ready Tool Co., Bridgeport, Conn.
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Detroit Broach Co., Detroit, Mich.
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Lake Shore Tool Works Div. 816 N. Kostner Ave., Chicago.
Lapointe Machine Tool Co., Hudson, Mass.
National Broach & Mch. Co., Detroit, Mich.
Super Tool Co., Detroit, Mich.

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Foote-Burt Co., Cleveland, O.
Lapointe Machine Tool Co., Hudson, Mass.
National Broach & Mch. Co., Detroit, Mich.

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Ampco Metal, Inc., Milwaukee, Wis.
Bunting Brass & Bronze Co., Toledo, O.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.
Jefferson Machine Tool Co., Cincinnati, O.
Johnson Bronze Co., New Castle, Pa.

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Gardner Mfg. Co., Beloit, Wis.
Production Machine Co., Greenfield, Mass.
Rotor Tool Co., Cleveland, O.

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Baldwin-Southwark Corp., Philadelphia, Pa.
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Lake Erie Engineering Corp., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.

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Bunting Brass & Bronze Co., Toledo, O.
Haynes Stellite Co., Kokomo, Ind.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

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Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago.
Leland-Gifford Co., Worcester, Mass.
U. S. Tool Co., Inc., Ampere, N. J.

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Ex-Cell-O Corp., Detroit, Mich.

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Starrett, L. S., Co., Athol, Mass.

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Pratt & Whitney Co., West Hartford, Conn.

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Rowbottom Machine Co., Waterbury, Conn.

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Metal Carbides Corp., Youngstown, O.
Super Tool Co., Detroit, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.

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Williams, J. H., & Co., 225 Lafayette St., New York.

CASE-HARDENING FURNACES

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On the Tabor Power Squeeze, Flask Lift Molding Machine, a NOPAK Model E, 4½" Air Cylinder moves the 350 lb. head into position for the squeeze, then moves it back so the finished mold can be removed, and a new flask inserted.

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Perhaps NOPAK Cylinder Power can help you speed up movements on your machines. Write for Bulletin 82-A.

NOPAK Jolt-Squeeze Valves are standard equipment on many molding machines, and may be used in the control of other types of machine movements. See Bulletin 86.

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Madison-Kipp Corporation, Madison, Wis.
Veeder-Root, Inc., Hartford, Conn.

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Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
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Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Super Tool Co., Detroit, Mich.

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Logansport Machine, Inc., Logansport, Ind.
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Van Norman Co., Springfield, Mass.

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National Twist Drill & Tool Co., Detroit, Mich.
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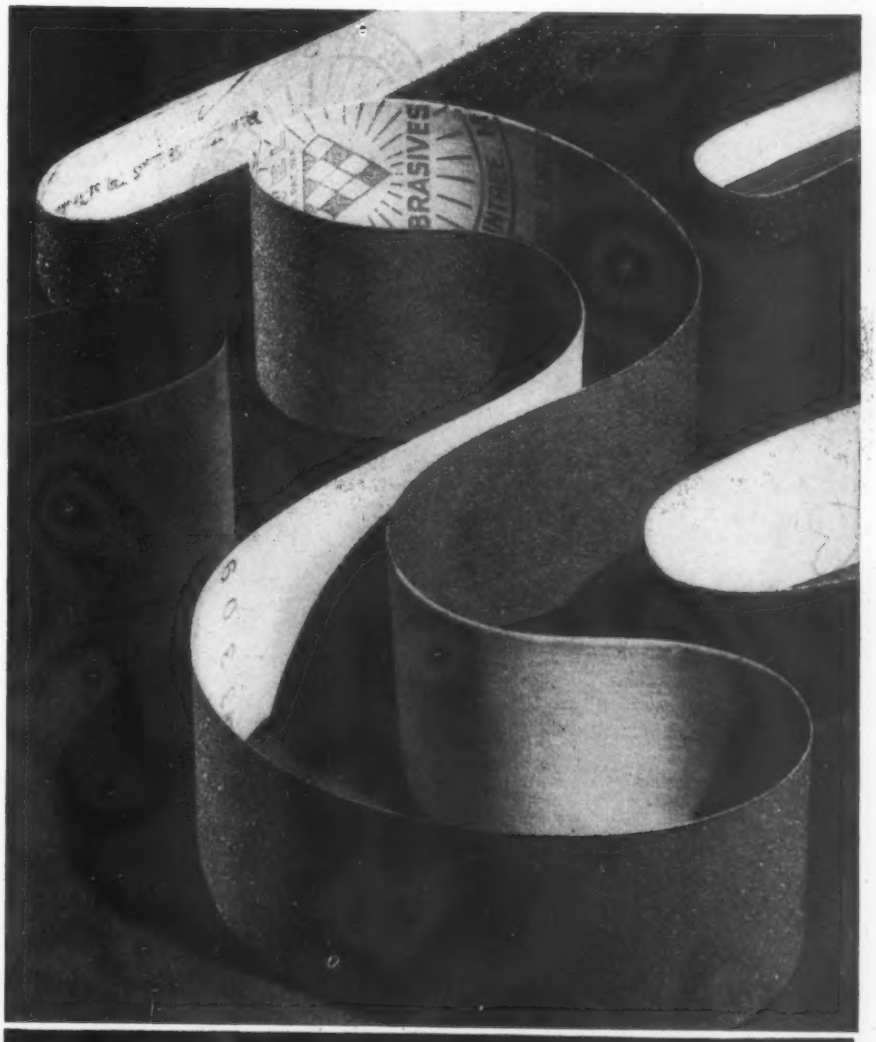

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Modern Tool Works, Rochester, N. Y.
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Grand Specialties Co., 3126 W. Grand Ave., Chicago, Ill.
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Williams, J. H., & Co., 225 Lafayette St., New York.

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Oakite Products, Inc., 26 Thames St., New York.
Quaker Chemical Products Corp., Conshohocken, Pa.

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Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Wks., Rochester, N. Y.
New Britain-Gridley Mch. Div., New Britain Machine Co., New Britain, Conn.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Stark Tool Co., Waltham, Mass.
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Scherr, George, Co., Inc., 126 Lafayette St., New York.

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Oakite Products, Inc., 26 Thames St., New York.
Quaker Chemical Products Corp., Conshohocken, Pa.

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Gulf Oil Corp., Pittsburgh, Pa.
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National Broach & Mch. Co., Detroit, Mich. (Broaching and Lapping)
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Quaker Chemical Products Corp., Conshohocken, Pa.
Richards, G. Whitefield, Philadelphia, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

COMPOUNDS, RESIN OR MOLDING

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General Electric Co., Schenectady, N. Y.

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Ingersoll-Rand Co., 11 Broadway, New York.

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Diefendorf Gear Corp., Syracuse, N. Y.
Ex-Cell-O Corp., Detroit, Mich.
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Hill Acme Co., Cleveland, O.
Jefferson Machine Tool Co., Cincinnati, O.
Kaydon Engrg. Corp., Muskegon, Mich.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Lees-Bradner Co., Cleveland, O.
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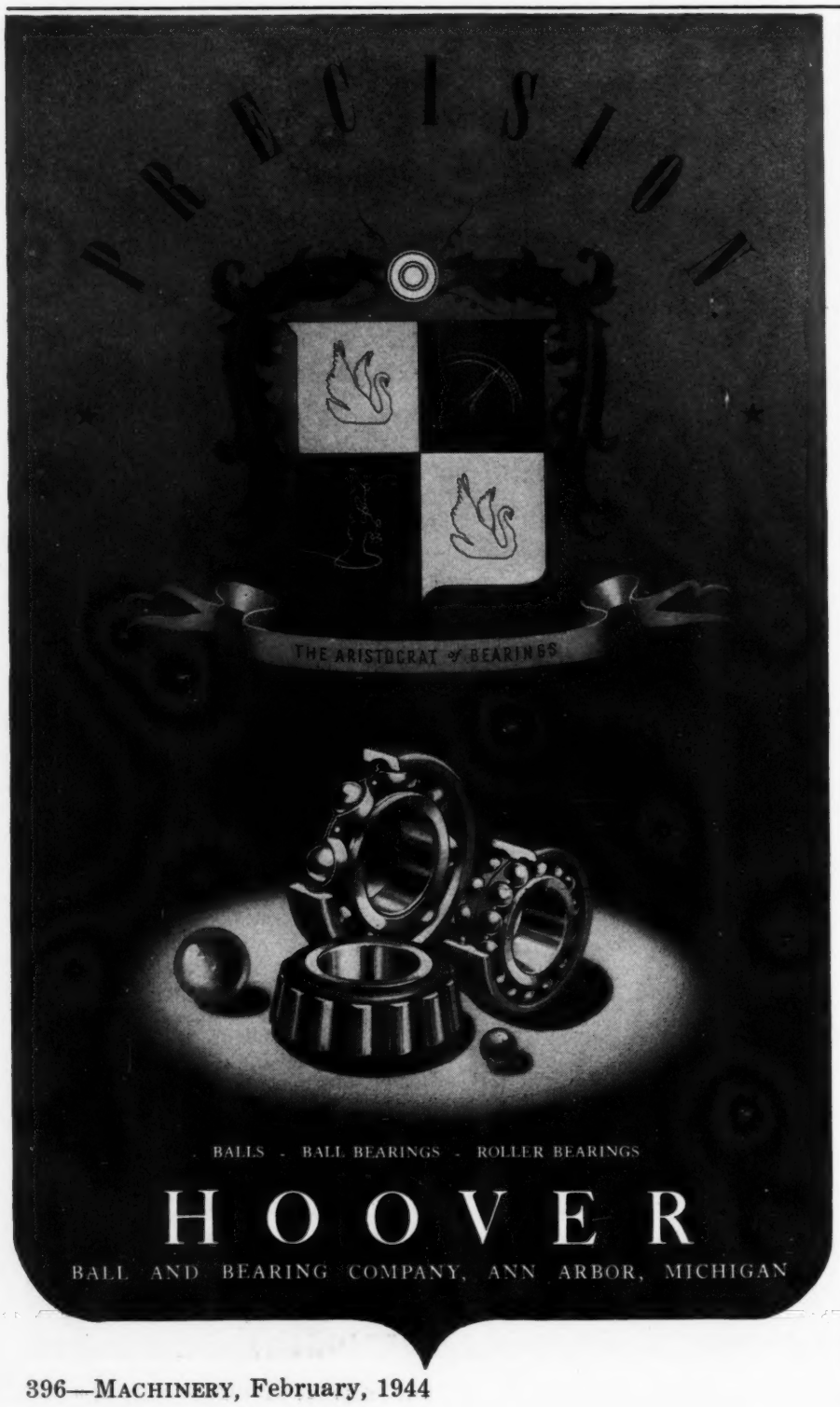
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Taylor-Shantz, Inc., Rochester, N. Y.
U. S. Tool Co., Inc., Ampere, N. J.
Wicaco Machine Corp., Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., Milwaukee, Wis.
Carbide Tool Co., 816 N. Kostner Ave., Chicago.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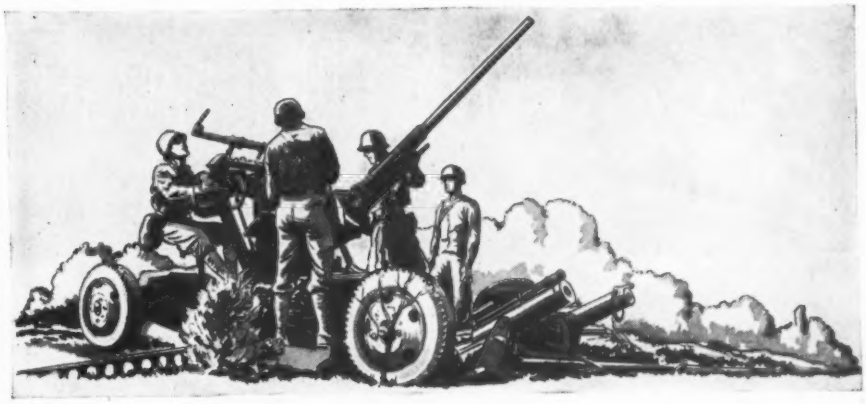

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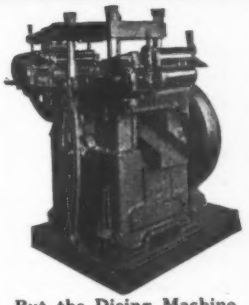

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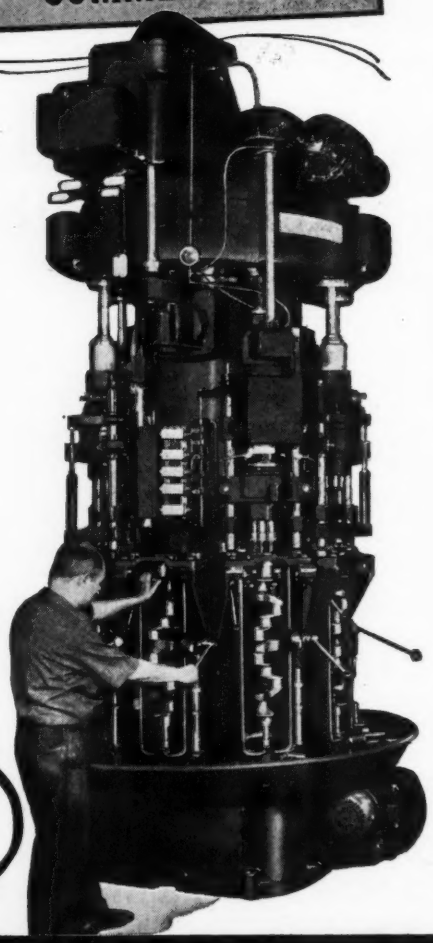

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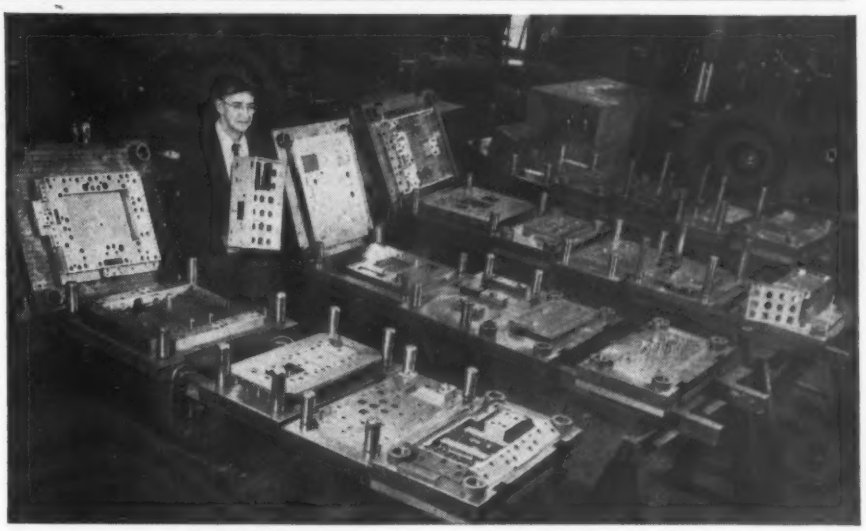
Bradford Machine Tool Co., Cincinnati, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee, Wis.
Frew Machine Co., Philadelphia, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Murchey Mch. & Tool Co., Detroit, Mich.
Sundstrand Mch. Tool Co., Rockford, Ill.



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Fosdick Machine Tool Co., Cincinnati, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
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Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Oakley, Cincinnati, O.
Cleereman Machine Tool Co., Green Bay, Wis.
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National Twist Drill & Tool Co., Detroit, Mich.
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National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
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Standard Tool Co., Cleveland, O.
Super Tool Co., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.

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See Grinding Wheels.

EMERY WHEEL DRESSERS
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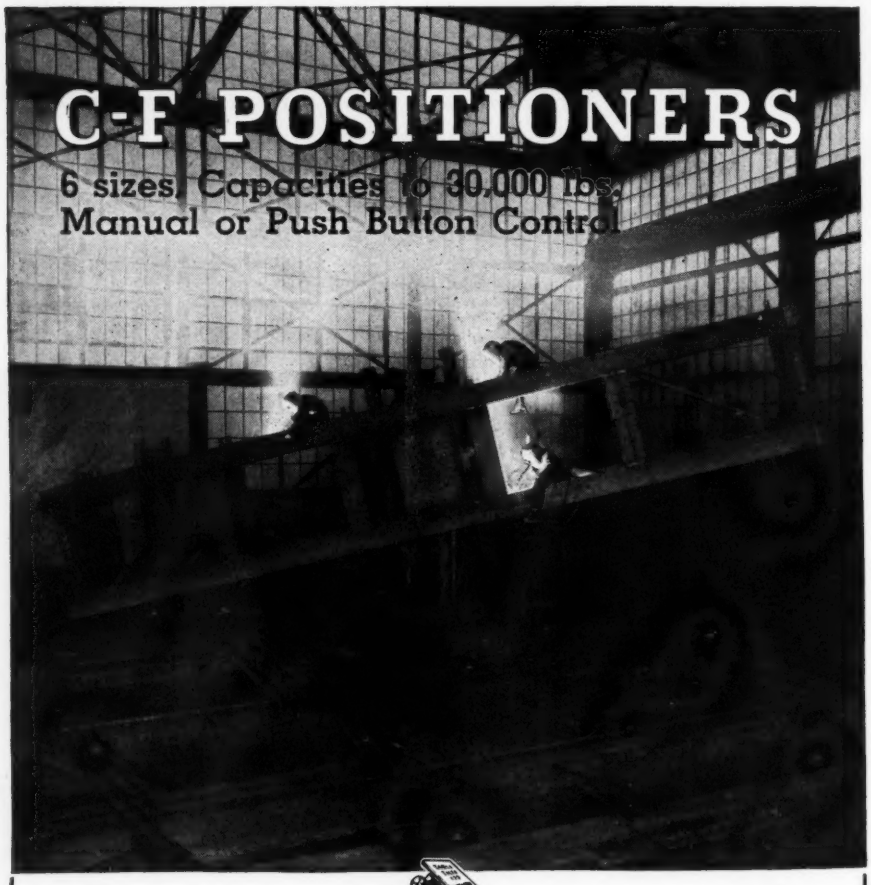

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Ex-Cell-O Corp., Detroit, Mich.
Federal Products Corp., Providence, R. I.
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See Speed Reducers

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Newark Gear Cutting Machine Co., Newark, N. J.
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Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GEARS, RAWHIDE AND NON-METALLIC

Atlantic Gear Works, Inc., 124 Lafayette St., N. Y.
Braun Gear Co., Brooklyn, N. Y.
Cincinnati Gear Co., Cincinnati, Ohio.
Diefendorf Gear Corp., Syracuse, N. Y.
Earle Gear & Mch. Co., Philadelphia, Pa.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Ganschow Gear Co., 14 N. Morgan St., Chicago.
General Electric Co., Pittsfield, Mass.
Grant Gear Works, Inc., Boston, Mass.
Hartford Special Mchy. Co., Hartford, Conn.
James, D. O. Mfg. Co., 1120 W. Monroe St., Chicago.
Massachusetts Gear & Tool Co., Woburn, Mass.
Meisel Press Mfg. Co., Boston, Mass.
Philadelphia Gear Works, Philadelphia, Pa.
Pittsburgh Gear & Machine Co., Pittsburgh, Pa.
Stahl Gear & Machine Co., Cleveland, O.
Taylor Mch. Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GENERATORS, ELECTRIC

General Electric Co., Schenectady, N. Y.
Janette Mfg. Co., 556 W. Monroe St., Chicago.
Master Electric Co., Dayton, Ohio.
Reliance Electric & Mfg. Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GOGGLES

American Optical Co., Southbridge, Mass.

GRADUATING MACHINES

Gorton, George, Mch. Co., Racine, Wis.
Noble & Westbrook Mfg. Co., Hartford, Conn.

GREASE

Cities Service Oil Co., 60 Wall Tower, New York.
Fiske Brothers Refining Co. (Lubriplate Div.), Newark, N. J.
Gulf Oil Corp., Pittsburgh, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), Chicago, Ill.
Sun Oil Co., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

GRINDERS, CARBIDE TOOL

Baldor Electric Co., St. Louis, Mo.
Oliver Instrument Co., Adrian, Mich.
Sundstrand Mch. Tool Co., Rockford, Ill.

GRINDERS, DIE AND MOLD

Consolidated Mch. Tool Corp., Rochester, N. Y.
Dumore Co., Racine, Wis.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Pratt & Whitney Co., West Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.

GRINDERS, OILSTONE, FOR WOODWORKING TOOLS

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, PNEUMATIC

Ingersoll-Rand Co., 11 Broadway, New York.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rotor Tool Co., Cleveland, O.

GRINDERS, PORTABLE ELECTRIC AND TOOLPOST

Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Dumore Co., Racine, Wis.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Schauer Machine Co., Cincinnati, O.
Skilsaw, Inc., 5039 Elston Ave., Chicago.

GRINDING MACHINES, ABRASIVE BELT

Continental Machines, Inc., Minneapolis, Minn.
Delta Mfg. Co., Milwaukee, Wis.
Hill Acme Co., Cleveland, O.
Mattison Mch. Wks., Rockford, Ill.
Porter-Cable Machine Co., Syracuse, N. Y.
Production Machine Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., 96 Warren St., New York.

GRINDING MACHINES, BENCH

Atlas Press Co., Kalamazoo, Mich.
Delta Mfg. Co., Milwaukee, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schauer Machine Co., Cincinnati, O.
Walker-Turner Co., Inc., Plainfield, N. J.

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Gear Grinding Machine Co., Detroit, Mich.

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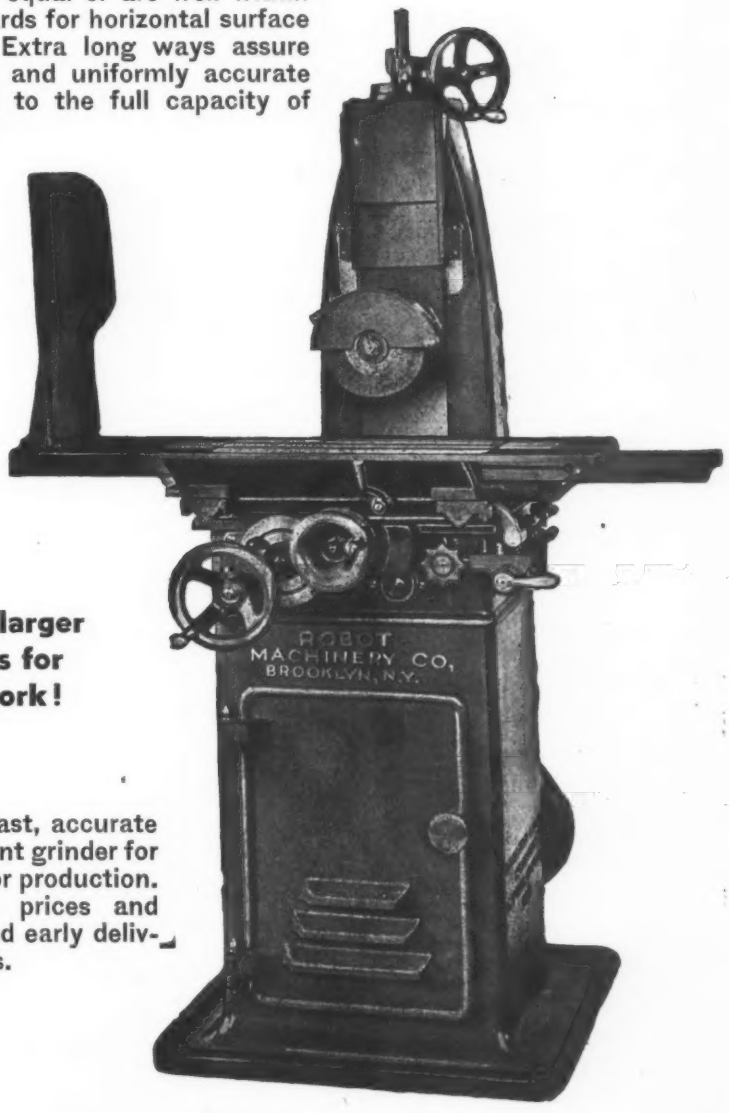

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Ex-Cell-O Corp., Detroit, Mich.
Oliver Instrument Co., Adrian, Mich.

GRINDING MACHINES, CENTERLESS
Cincinnati Grinders, Inc., Cincinnati, O.

GRINDING MACHINES, CHASER, OR DIE
Eastern Mch. Screw Corp., New Haven, Conn.
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, CHUCKING
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.

GRINDING MACHINES, CRANKSHAFT
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, CYLINDER
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, CYLINDRICAL
Arter Grinding Machine Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, O.
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Wks. (Cons. Mch. Tool Corp).
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Thompson Grinder Co., Springfield, O.

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Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gardner Machine Co., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Porter-Cable Machine Co., Syracuse, N. Y.
Production Mch. Co., Greenfield, Mass.

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Delta Mfg. Co., Milwaukee, Wis.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, FACE
Abrasive Mch. Tool Co., E. Providence, R. I.
Diamond Machine Co., Philadelphia, Pa.
Hanchett Mfg. Co., Big Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.

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See Flexible Shaft Equipment.

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National Tool Co., Cleveland, O.

GRINDING MACHINES FOR SHARPENING TURNING AND PLANING TOOLS
Delta Mfg. Co., Milwaukee, Wis.
General Machinery Corp., Boston, Mass.
Oliver Instrument Co., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Production Mch. Co., Greenfield, Mass.
Rogers, Samuel C., & Co., Buffalo, N. Y.
Sellers, Wm., & Co., Inc., Philadelphia, Pa. (Machine Ground)
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Mch. Wks., Waltham, Mass.

GRINDING MACHINES, INTERNAL
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Wks. (Cons. Mch. Tool Corp.), Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, JIG
Moore Special Tool Co., Inc., Bridgeport, Conn.

GRINDING MACHINES, KNIFE AND SHEAR BLADE
Hanchett Mfg. Co., Big Rapids, Mich.
Hill Acme Co., Cleveland, O.

GRINDING MACHINES, PISTON RING
Arter Grinding Machine Co., Worcester, Mass.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES, PROFILE
Boyar-Schultz Corp., Walnut St. at Hoyne, Chicago.

GRINDING MACHINES, PULLEY
Abrasive Mch. Tool Co., East Providence, R. I.

GRINDING MACHINES, RADIAL, BALL RACE, ETC.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, RADIUS, LINK
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.

GRINDING MACHINES, RING WHEEL
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gardner Machine Co., Beloit, Wis.

GRINDING MACHINES, ROLL
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, SPLINE
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit, Mich.

GRINDING MACHINES, SURFACE
Abrasive Mch. Tool Co., E. Providence, R. I.
Arter Grinding Machine Co., Worcester, Mass.
Blanchard Mch. Co., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis, Minn.
Foote-Burt Co., Cleveland, O.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Mch. Co., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Heald Machine Co., Worcester, Mass.
Hill Acme Co., Cleveland, O.
Leach, H., Machinery Co., Providence, R. I.
Mattison Machine Works, Rockford, Ill.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Robot Machinery Co., 326 Ten Eyck St., Brooklyn, N. Y.
Savage Tool Co., Savage, Minn.
Sommer & Adams Co., Cleveland, O.
Thompson Grinder Co., Springfield, O.
Walker, O. S., Co., Inc., Worcester, Mass.

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Jefferson Machine Tool Co., Cincinnati, O.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

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Jones & Lamson Mch. Co., Springfield, Vt.

GRINDING MACHINES, THREAD
Ex-Cell-O Corp., Detroit, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.

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Cincinnati Milling Mch. Co., Oakley, Cincinnati, O.
Cleveland Tool Engineering Co., Cleveland, O.
Continental Machines, Inc., Minneapolis, Minn.
Fellows Gear Shaper Co., Springfield, Vt. (Helical Gear Shaper Cutters).
Fitchburg Grinding Mch. Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, WORM
Gear Grinding Machine Co., Detroit, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., West Hartford, Conn.

GRINDING WHEELS
Abrasive Co., Bridesburg, Philadelphia, Pa.
Bakelite Corp., 30 E. 42nd St., New York.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Blanchard Mfg. Co., Cambridge, Mass.
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago.
Cortland Grinding Wheels Corp., Chester, Mass.
deSanno, A. P., & Son, Inc., Phoenixville, Pa.
Felker Mfg. Co., Torrance, Calif.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Norton Co., Worcester, Mass.
Vitrified Wheel Co., Westfield, Mass.

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Taylor-Shantz, Inc., Rochester, N. Y.

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Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engineering Co., Alliance, O.

HAMMERS, PNEUMATIC
Madison-Kipp Corp., Madison, Wis.

HAMMERS, POWER
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.

HAMMERS, SOFT
Chambersburg Engineering Co., Chambersburg, Pa.
Greene, Tweed & Co., Bronx Blvd. & 238th St., New York.
S. & H. Soft Hammer Products Co., Detroit, Mich.

HAMMERS, STEAM
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.

HANGERS, SHAFT
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland, O.
Hyatt Bearings Div. General Motors Sales Corp., Harrison, N. J.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
S K F Industries, Inc., Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HARDENING EQUIPMENT, INDUCTION
Ohio Crankshaft Co., Cleveland, O.

HARDNESS TESTING INSTRUMENTS
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Shore Instrument & Mfg. Co., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 382 Concord Ave., N. Y.

HEAT TREATMENT OF STEEL
Bennett Metal Treating Co., Elmwood, Conn.
Davis Boring Tool Div., St. Louis, Mo.
Ohio Gear Co., Cleveland, O.
Pittsburgh Gear & Mch. Co., Pittsburgh, O.
Woodworth, N. A., Co., Detroit 20, Mich.

HOBBING MACHINES
See Gear Cutting Machines, Helical and Spur (Hob), and Gear Cutting Machines, Worm and Worm Wheels.

HOBBING MACHINES, MULTIPLE-SPLINE
Sommer & Adams Co., Cleveland, O.

HOBS
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lake Shore Tool Works Div. 816 N. Kostner Ave., Chicago.
Lees-Bradner Co., Cleveland, O.
Michigan Tool Co., Detroit, Mich.
National Twist Drill & Tool Co., Detroit, Mich.
New Jersey Gear & Mfg. Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.
U. S. Machine Tool Mfg. Corp., Terre Haute, Ind.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H., & Co., 225 Lafayette St., New York.

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Chisholm-Moore Hoist Corporation, Tonawanda, N. Y.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOISTS, AIR
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Ingersoll-Rand Co., 11 Broadway, New York.

HOISTS, CHAIN, ETC.
Chester Mfg. Co., Lisbon, O.
Chisholm-Moore Hoist Corporation, Tonawanda, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

HOISTS, ELECTRIC
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Philadelphia Gear Works, Philadelphia, Pa.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONES
Carborundum Co., Niagara Falls, N. Y.
Micromatic Hone Corp., Detroit, Mich.
Moline Tool Co., Moline, Ill.
Sunnen Products Co., St. Louis, Mo.

HONING MACHINES, CYLINDER
Automotive Maintenance Mchry. Co., 2100 Commonwealth Ave., Chicago.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. and John, Co., Rockford, Ill.
Micromatic Hone Corp., Detroit, Mich.
Moline Tool Co., Moline, Ill.
Sunnen Products Co., St. Louis, Mo.

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Barnes Drill Co., Rockford, Ill.
Micromatic Hone Corp., Detroit, Mich.

HOSE, LEATHER, RUBBER, METALLIC, ETC.
Fauver, J. N., Co., Inc., Detroit, Mich.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Weatherhead Co., Cleveland, O.

HOSE, REEL
Schrader's Sons, A., Div., Brooklyn, N. Y.

HYDRAULIC MACHINERY, TOOLS AND EQUIPMENT
Baldwin-Southwark Corp., Philadelphia, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Denison Engineering Co., Columbus, O.
Farquhar, A. B., Co., Ltd., York, Pa.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydropress Co., Inc., 570 Lexington Ave., New York, N. Y.
Lake Erie Engineering Corp., Buffalo, N. Y.
Rockford Machine Tool Co., Rockford, Ill.
Sundstrand Mch. Tool Co., Rockford, Ill.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., Philadelphia, Pa.

HYDRAULIC POWER UNITS OR TOOL HEADS
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John, Co., Rockford, Ill.
Ex-Cell-O Corp., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

HYDRAULIC TOOL HEAD OR POWER UNIT
Barnes Drill Co., Rockford, Ill.
New Britain-Gridley Mch. Div., New Britain Machine Co., New Britain, Conn.

INDEX CENTERS
Abrasive Mch. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Jefferson Machine Tool Co., Cincinnati, O.
Kempsmith Mch. Co., Milwaukee, Wis.
Vard, Inc., Pasadena, Calif.

INDEXING AND SPACING FIXTURES
Hartford Special Mchry. Co., Hartford, Conn.
Vard, Inc., Pasadena, Calif.
Zagar Tool, Inc., Cleveland, O.

INDICATORS, DIAL
Ames, B. C., Co., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

INDICATORS, SPEED
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, L. S., Co., Athol, Mass.
Veeder-Root, Inc., Hartford, Conn.

INDICATORS, TEST
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

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Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

INSPECTION DEVICES
Schultz & Anderson Co., Newark, N. J.

INTENSIFIERS, HYDRAULIC
Baldwin-Southwark Corp., Philadelphia, Pa.
Farquhar, A. B., Co., York, Pa.
Morgan Engineering Co., Alliance, O.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., Philadelphia, Pa.

JACKS, PLANER
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.

JIG BORER—See Boring Machines, Jig.

JIGS AND FIXTURES
American Measuring Instruments Corp., 240 W. 40th St., New York.
Columbus Die, Tool & Mch. Co., Columbus, O.
Ex-Cell-O Corp., Detroit, Mich.
Hartford Special Mchy. Co., Hartford, Conn.
Logansport Machine, Inc., Logansport, Ind.
Modern Mch. Corp., Brooklyn, N. Y.
Quality Tool & Die Co., Indianapolis, Ind.
Sommer & Adams Co., Cleveland, O.
Sossner, Inc., New York.
Sundstrand Mch. Tool Co., Rockford, Ill.

KEYS, WOODRUFF TYPE
Whitney Chain & Mfg. Co., Hartford, Conn.

KEYSEATERS
Baker Bros., Inc., Toledo, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
Lapointe Machine Tool Co., Hudson, Mass.

KNURL HOLDERS
Graham Mfg. Co., Inc., E. Greenwich, R. I.
Pratt & Whitney Co., West Hartford, Conn.

KNURLING TOOLS
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Graham Mfg. Co., Inc., E. Greenwich, R. I.
Pratt & Whitney Co., West Hartford, Conn.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

LAPPING MACHINES
Automotive Maintenance Mchry. Co., 2100 Commonwealth Ave., Chicago.
Cincinnati Grinders, Inc., Cincinnati.
Ex-Cell-O Corp., Detroit.
Fellows Gear Shaper Co., Springfield, Vt.
Norton Co., Worcester, Mass.

LAPPING PLATES
American Gauge Co., Dayton, Ohio.

LATHE ATTACHMENTS
American Tool Wks. Co., Cincinnati.
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Bradford Machine Tool Co., Cincinnati, O.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Gisholt Mch. Co., Madison, Wis.
Jefferson Machine Tool Co., Cincinnati, O.
Jones & Lamson Mch. Co., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
McCrosky Tool Corp., Meadville, Pa.
Monarch Mch. Tool Co., Sidney, O.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, O.
Stark Tool Co., Waltham, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.
Utility Tool & Die Mfrs., Los Angeles, Cal.
Vard, Inc., Pasadena, Calif.
Warner & Swasey Co., Cleveland.

LATHE DOGS
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Ready Tool Co., Bridgeport, Conn.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

LATHES, AUTOMATIC
Baird Machine Co., Stratford, Conn.
Gisholt Mch. Co., Madison, Wis.
Goss & DeLeeuw Mch. Co., New Britain, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Monarch Mch. Tool Co., Sidney, O.
National Acme Co., Cleveland.
New Britain-Gridley Mch. Div., New Britain Machine Co., New Britain, Conn.
Porter-Cable Machine Co., Syracuse, N. Y.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Wickes Bros., Saginaw, Mich.

LATHES, AXLES AND SHAFT
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Sellers, Wm., & Co., Inc., Philadelphia.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.

LATHES, BENCH
Ames, B. C., Co., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Hardinge Brothers, Inc., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Pratt & Whitney Co., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 246 N. Knox Ave., Chicago.
South Bend Lathe Wks., Inc., South Bend, Ind.
Stark Tool Co., Waltham, Mass.

LATHES, BORING
Gisholt Mch. Co., Madison, Wis.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Wickes Bros., Saginaw, Mich.

LATHES, BRASS WORKERS'
Acme Machine Tool Co., Cincinnati, O.
Bardons & Oliver, Inc., Cleveland, O.
Gisholt Mch. Co., Madison, Wis.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Warner & Swasey Co., Cleveland.

LATHES, CRANKSHAFT
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Sundstrand Mch. Tool Co., Rockford, Ill.
Wickes Bros., Saginaw, Mich.

LATHES, DOUBLE-END
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Wickes Bros., Saginaw, Mich.

LATHES, ENGINE AND TOOLROOM
Acme Machine Tool Co., Cincinnati, O.
American Tool Wks. Co., Cincinnati.
Atlas Press Co., Kalamazoo, Mich.
Axelson Manufacturing Co., Los Angeles, Calif.
Bradford Machine Tool Co., Cincinnati, O.
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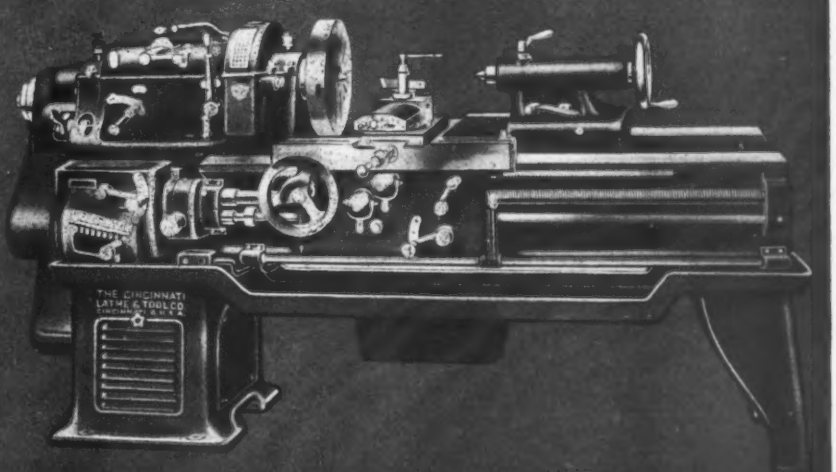
Rugged Precision Construction Maintains Uniform Output

Gears cut to a special, high-efficiency tooth form . . . extra heavy bed with wide ways . . . accurately ground spindle, precision mounted on tapered roller bearings—these and many other exclusive patented features make it possible to give Cincinnati Lathes any assignment with the assurance that results will be accurate and production high! Produced in 14" to 30" sizes. Full details given in our latest catalog. Write for your copy!



THE CINCINNATI LATHE & TOOL CO.
SPECIALISTS SINCE 1906
Disney Drive Oakley, Cincinnati, O.

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lehmann Machine Co., St. Louis, Mo.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Logan Engineering Co., 4901 Lawrence Ave., Chicago.
Monarch Mch. Tool Co., Sidney, O.
Morey Machinery Co., Inc., 410 Broome St., New York.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4246 N. Knox Ave., Chicago.
Sidney Machine Tool Co., Sidney, O.
Simmons Machine Tool Corp., Albany, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, O.
Wickes Bros., Saginaw, Mich.

LATHES, EXTENSION BED AND GAP

Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Gisholt Mch. Co., Madison, Wis.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Warner & Swasey Co., Cleveland.

LATHES, GUN

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lodge & Shipley Mch. Tool Co., Cincinnati.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Wickes Bros., Saginaw, Mich.

LATHES, MANUFACTURING TYPE

Lipe-Rollway Corporation, Syracuse, N. Y.
Lodge & Shipley Mch. Tool Co., Cincinnati.

LATHES, SPINNING

See Chucking Machines.

LATHES, TOOLROOM

See Lathes, Engine and Toolroom.

LATHES, TURRET

Acme Machine Tool Co., Cincinnati, O.
Bardons & Oliver, Inc., Cleveland, O.
Bullard Company, Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Oakley, Cincinnati.
Diehl, G. M., Machine Wks., Wabash, Ind.
Gisholt Mch. Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y. (Bench or Cabinet Mounting).
Jones & Lamson Mch. Co., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Morey Machinery Co., 410 Broome St., New York, N. Y.
National Acme Co., Cleveland.
Oster Mfg. Co., Cleveland, O.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Production Machine Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Simmons Machine Tool Corp., Albany, N. Y.
South Bend Lathe Wks., Inc., South Bend, Ind.
Springfield Mch. Tool Co., Cleveland, O.
Stark Tool Co., Waltham, Mass.
Warner & Swasey Co., Cleveland, O.

LATHES, TURRET AUTOMATIC

Potter & Johnston Mch. Co., Pawtucket, R. I.

LATHES, VERTICAL TURRET

Bullard Company, Bridgeport, Conn.
Rogers Machine Works, Inc., Buffalo 7, N. Y.

LAY-OUT FLUID

Rogers, Dayton, Mfg. Co., Minneapolis, Minn.

LEVELS

Pratt & Whitney Co., West Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.
Universal Boring Mch. Co., Hudson, Mass.

LUBRICANTS, INCLUDING EXTREME PRESSURE (E.P.) MACHINERY LUBRICANTS

Cities Service Oil Co., 60 Wall Tower, New York.
Fiske Brothers Refining Co. (Lubriplate Div.), Newark, N. J.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Quaker Chemical Products Corp., Conshohocken, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York

LUBRICATING SYSTEMS

Farval Corp., Cleveland.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, etc.

MAGNESIUM

Dow Chemical Co., Midland, Mich.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES

Noble & Westbrook Mfg. Co., Hartford, Conn.

MEASURING MACHINES, PRECISION

Federal Products Corp., Providence, R. I.
Hanson-Whitney Mch. Co., Hartford, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Pratt & Whitney Co., West Hartford, Conn.
Van Keuren Co., Watertown, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Van Keuren Co., Watertown, Mass.

METALS, BEARING

See Bearings, Bronze, Babbitt, etc., and Bushings, Brass, Bronze, etc.

METALS, PERFORATED

Chicago Perforating Co., 2445 W. 24th Pl., Chicago.

METERS (See Recording Instruments).

MICROMETERS

Bartelt Engineering Co., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Central Tool Co., Auburn, R. I.
Davis & Thompson Co., Milwaukee, Wis.
Pratt & Whitney Co., West Hartford, Conn.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Starrett, L. S., Co., Athol, Mass.
Van Keuren Co., Watertown, Mass.

MICROSCOPES, TOOLMAKERS

Scherr, George, Co., Inc., 126 Lafayette St., New York.

MILLING ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Jefferson Machine Tool Co., Cincinnati, O.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Mch. Co., Milwaukee, Wis.
Porter-Cable Machine Co., Syracuse, N. Y.
Reed-Prentice Corp., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Co., Springfield, Mass.

MILLING MACHINES, AUTOMATIC

Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Jefferson Machine Tool Co., Cincinnati, O.
Jones & Lamson Mch. Co., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., Rockford, Ill.
U. S. Tool Company, Inc., Ampere, N. J.

MILLING MACHINES, BENCH

Ames, B. C., Co., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Burke Machine Tool Co., Conneaut, O.
Hardinge Brothers, Inc., Elmira, N. Y. (Bench or Pedestal Type).
Jefferson Machine Tool Co., Cincinnati, O.
Pratt & Whitney Tool Co., West Hartford, Conn.
Stark Tool Co., Waltham, Mass.

MILLING MACHINES, CIRCULAR CONTINUOUS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, DIE SINKING

See Die Sinking Machines.

MILLING MACHINES, DUPLEX

Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.

MILLING MACHINES, HAND

Burke Machine Tool Co., Cincinnati, O.
Frew Machine Co., Philadelphia.
Jefferson Machine Tool Co., Cincinnati, O.
Nichols, W. H., & Sons, Waltham, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Co., Springfield, Mass.

MILLING MACHINES, HORIZONTAL, PLAIN AND UNIVERSAL

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Continental Machines, Inc., Minneapolis, Minn.
DeVlieg Machine Co., Ferndale, Mich.
Frew Machine Co., Philadelphia.
Gorton, George, Mch. Co., Racine, Wis.
Jefferson Machine Tool Co., Cincinnati, O.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Mch. Co., Milwaukee, Wis.
Machinery Mfg. Co., Los Angeles, Calif.
Ohio Machine Tool Co., Kenton, O.
Producto Machine Co., Bridgeport, Conn.
Sidney Machine Tool Co., Sidney, O.
Simmons Machine Tool Corp., Albany, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, LINCOLN TYPE

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, PLANER TYPE

Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sellers, Wm., & Co., Inc., Philadelphia.
Stokerunit Corp., Milwaukee, Wis.

MILLING MACHINES, PLANETARY

Cross Gear & Machinery Co., Detroit, Mich.
Hall Planetary Co., Fox St., and Abbotsford Ave., Philadelphia, Pa.
Plan-O-Mill Corp., Hazel Park, Mich.

MILLING MACHINES, RAM TYPE, UNIVERSAL

Cross Gear & Machine Co., Detroit, Mich.
Van Norman Co., Springfield, Mass.

MILLING MACHINES, VERTICAL

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Continental Machines, Inc., Minneapolis, Minn.
Gorton, George, Mch. Co., Racine, Wis.
Jefferson Machine Tool Co., Cincinnati, O.
Kearney & Trecker Corp., Milwaukee, Wis.
Machinery Mfg. Co., Los Angeles, Calif.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Sidney Machine Tool Co., Sidney, O.
Sommer & Adams Co., Cleveland, O.
Sundstrand Mch. Tool Co., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK

See Special Machinery Tools.

MOLD AND DIE COPYING MACHINES

Gorton, George, Mch. Co., Racine, Wis.

MOLDING MACHINES, PLASTIC PRODUCTS

Reed-Prentice Corp., Worcester, Mass.
Watson-Stillman Co., Roselle, N. J.

MOLYBDENUM

Climax Molybdenum, 500 Fifth Ave., New York.
Molybdenum Corp. of America, Pittsburgh, Pa.

MOTION PICTURES, EDUCATIONAL

Castle Films, Inc., RCA Bldg., New York, N. Y.

MOTORIZED SPEED REDUCERS

Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.

MOTORS, ELECTRIC

Baldor Electric Co., St. Louis, Mo.
Dumore Co., Racine, Wis.
General Electric Co., Schenectady, N. Y.
Holtzer-Cabot Electric Co., Boston, Mass.
Janette Mfg. Co., 556 W. Monroe St., Chicago.
Lincoln Electric Co., Cleveland.
Master Electric Co., Dayton, Ohio.
Reliance Electric & Engrg. Co., Cleveland.
Star Electric Motor Co., Bloomfield, N. J.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., E. Pittsburgh.

MULTIPLE-SLIDE FORMING MACHINES

Baird Machine Co., Stratford, Conn.
U. S. Tool Co., Inc., Ampere, N. J.

NAME PLATES

Jefferson Machine Tool Co., Cincinnati, O.
Noble & Westbrook Mfg. Co., Hartford, Conn.

NIBBLING MACHINES

Campbell, Andrew C., Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Gray Machine Co., Philadelphia.
Schatz Mfg. Co., Poughkeepsie, N. Y.

NICKEL

International Nickel Co., 67 Wall St., New York.

NIPPLE THREADING MACHINERY

Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
Oster Manufacturing Co., Cleveland, O.

NUMBERING MACHINES

Noble & Westbrook Mfg. Co., Hartford, Conn.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, COLD FORGED, WING AND CAP

Parker-Kalon Corp., 200 Varick St., New York.

NUTS, THUMB OR WING AND CAP

Williams, J. H., & Co., 225 Lafayette St., New York.

OIL CUPS

Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.
Trico Fuse Mfg. Co., Milwaukee, Wis.

OIL GROOVERS

Fischer Machine Co., Philadelphia, Pa.
Hanson-Whitney Mch. Co., Hartford, Conn.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OIL HOLE COVERS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.
Madison-Kipp Corp., Madison, Wis.
Trico Fuse Mfg. Co., Milwaukee, Wis.

OILS, CUTTING

Acheson Colloids Corp., Port Huron, Mich.
Cities Service Oil Co., 60 Wall Tower, New York.
Fearless Oil Co., Los Angeles 15, Cal.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago 23, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

OILS, LUBRICATING

Acheson Colloids Corp., Port Huron, Mich.
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago, Ill.
Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Fiske Brothers Refining Co. (Lubriplate Div.), Newark, N. J.
Quaker Chemical Products Corp., Conshohocken, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.
Sun Oil Co., Philadelphia.
Texas Co., 135 E. 42nd St., New York.
Tide Water Associated Oil Co., 17 Battery Pl., New York.

OILS, QUENCHING AND TEMPERING

Cities Service Oil Co., 60 Wall Tower, New York.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Quaker Chemical Products Corp., Conshohocken, Pa.
Shell Oil Co., Inc., New York, St. Louis, San Francisco.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago.
Stuart, D. A., Oil Co., Ltd., 2727 So. Troy St., Chicago, Ill.

OILS, SOLUBLE—See Compounds, Cutting, Grinding, Metal Drawing, etc.

ORDNANCE MACHINES, SPECIAL

Rehnberg-Jacobson Mfg. Co., Rockford, Ill.

PACKING, LEATHER, METAL, RUBBER, ASBESTOS, ETC.
Garlock Packing Co., Palmyra, N. Y.
Greene, Tweed & Co., Bronx Blvd. & 238th St., New York.
Houghton, E. F., & Co., Philadelphia, Pa.
Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Watson-Stillman Co., Roselle, N. J.

PAINTS FOR MACHINE PARTS
Lowe Bros., Co., Dayton, Ohio.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, WOOD
Mummert-Dixon Co., Hanover, Pa.

PHOSPHOR BRONZE—See Bronze.

PILLOW BLOCKS
Hill Acme Co., Cleveland, O.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE BEVELING MACHINE, OXYACETYLENE
H. & M. Pipe Beveling Mch. Co., Tulsa, Okla.

PIPE, BRASS AND COPPER
American Brass Co., Waterbury, Conn.

PIPE CUTTING AND THREADING MACHINES
Foote-Burt Co., Cleveland, O.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
Oster Manufacturing Co., Cleveland, O.
Peerless Machine Co., 1613 Racine St., Racine, Wis.

PIPE, STEEL
Bethlehem Steel Co., Bethlehem, Pa.
National Tube Co. (U. S. Steel Corp. Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

PIPE TONGS
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

PLANER ATTACHMENTS
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hanson-Whitney Mch. Co., Hartford, Conn.
Rockford Machine Tool Co., Rockford, Ill.

PLANERS
Baldwin-Southwark Corp., Philadelphia, Pa.
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. Tool Corp., Rochester, N. Y. (Incl. Plate, Rotary and Crank Types).
Liberty Planers, Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Rockford Mch. Tool Co., Rockford, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.
Underwood, H. B., Corp., Philadelphia, Pa.

PLANERS, OPEN-SIDE
Cincinnati Planer Co., Cincinnati.
Liberty Planers, Hamilton, O.
Rockford Machine Tool Co., Rockford, Ill.

PLASTICS AND PLASTIC PRODUCTS
Bakelite Corp., 30 E. 42nd St., New York.

PLATE ROLLS
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Corp., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.

PLATES, SURFACE
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Glass Co., 900 W. Cermak, Chicago, Ill.
Jones Machine Tool Wks., Inc., Valley Forge, Pa.
Rotor Tool Co., Cleveland, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Company, Inc., Ampere, N. J.

PNEUMATIC EQUIPMENT
Airgrip Chuck Div., Anker-Holth Mfg. Co., 332 So. Michigan Ave., Chicago.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Ingersoll-Rand Co., 11 Broadway, New York.
Logansport Machine, Inc., Logansport, Ind.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

POLISHING LATHES AND MACHINES
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Continental Machines, Inc., Minneapolis, Minn.
Gardner Machine Co., Beloit, Wis.
Production Mch. Co., Greenfield, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.

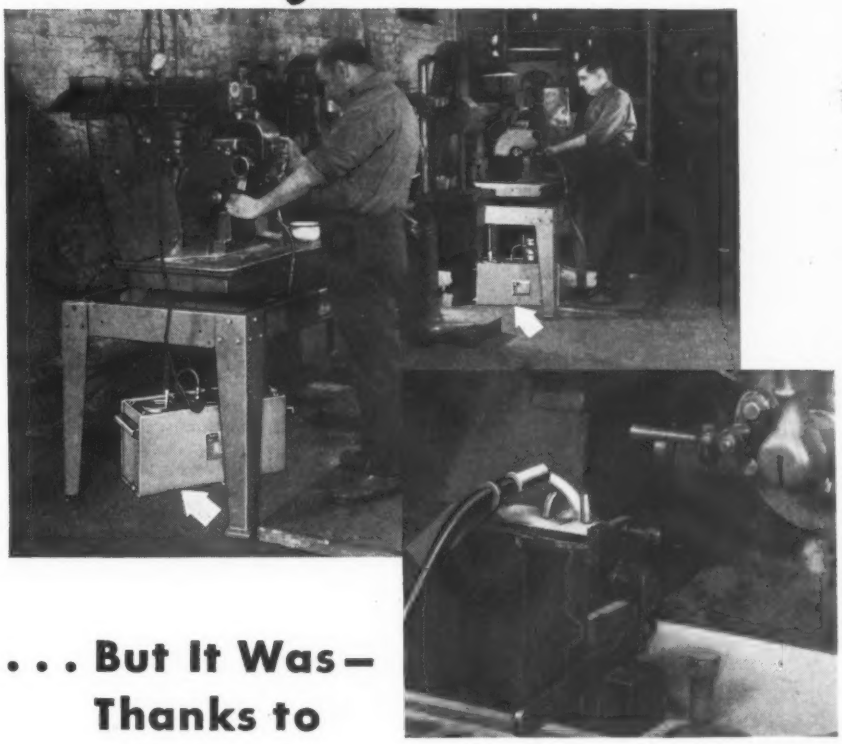
POLISHING TOOLS, PORTABLE
Jarvis, Chas. L., Co., Middletown, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago.

POLISHING WHEELS
Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia, Pa.
Famco Machine Co., Racine, Wis.
Farquhar, A. B., Co., Ltd., York, Pa.
General Mfg. Co., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Logansport Machine, Inc., Logansport, Ind.
Sheldon Mch. Co., 4246 N. Knox Ave., Chicago.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.

PRESSES, BROACHING
American Broach & Mch. Co., Ann Arbor, Mich.

THIS JOB *Couldn't Be Done*



. . . But It Was— Thanks to

GRAY-MILLS *Portable Coolant Systems*

THIS job of cutting magnetic steel couldn't be done, because these Radial Cutter Grinders were not originally equipped for coolants. Yet, the job was done . . . by applying the coolant with Gray-Mills G-3A Portable Coolant Systems.

Today, as this application illustrates, there is no need to forego the advantages of coolants even though your machines aren't equipped with coolant applying systems. Gray-Mills Portable coolant systems are moderate in cost . . . can be hooked up for operation by your own maintenance man quickly, without fuss. In savings on tools alone, Gray-Mills Systems will pay for themselves within a few months.

Gray-Mills Portable Coolant Systems offer all of the advantages of built-in systems: controlled flow; capacities up to 3000 gals. per hr., high volume, or high pressure, baffle plates and screens to filter out chips and abrasives. An automatic pressure relief valve protects the motor against overloads.

Don't deny yourself production-jumping, tool-saving, cost reducing coolants. Apply them with Gray-Mills, (self-contained) Portable Coolant Systems. Ask your mill supply or machinery distributor for a demonstration.

Write for Complete Details.

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208 W. Ontario Street ★ Chicago 10, Illinois

4 Heavy Duty "A" Series Models—with large capacity coolant tanks incorporating forced settling baffles and screen strainers. Capacities from 60 to 180 G.P.H., Pressures from 15 to 50 lbs. P.S.I.

3 Model "G" Series (Round Tanks). Small compact units—with capacities from 60 to 130 G. P. H., Pressures from 10 to 20 lbs. P. S. I.

GRAY-MILLS

Complete Portable

COOLANT SYSTEMS

Use GRAY-MILLS COOLANTS . . . 5 types for most requirements—10 and 55 gal. containers—immediate delivery from your distributor or our plant.

Ferracute Machine Co., Bridgeton, N. J.
General Mfg. Co., Detroit, Mich.
Lapointe Machine Tool Co., Hudson, Mass.
Peck, Stow & Wilcox Co., Southington, Conn.
V & O Press Co., Hudson, N. Y.
Watson-Stillman Co., Roselle, N. J.

PRESSES, EXTRUSION

Hydropress Co., Inc., 570 Lexington Ave., New York, N. Y.
Lake Erie Engineering Corp., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

PRESSES, FOOT

Baird Machine Co., Stratford, Conn.
Etna Machine Co., Toledo, O.
Famco Machine Co., Racine, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
V & O Press Co., Hudson, N. Y.

PRESSES, FORGING

Ajax Manufacturing Co., Cleveland, Ohio.
Baldwin-Southwark Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Cleveland Punch & Shear Works Co., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Co., York, Pa.
Ferracute Machine Co., Brigeton, N. J.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydropress Co., Inc., 570 Lexington Ave., New York, N. Y.
Lake Erie Engineering Corp., Buffalo, N. Y.
Morgan Engineering Co., Alliance, O.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., Philadelphia, Pa.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, HYDRAULIC

American Broach & Mch. Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Clearing Mch. Co., 6499 W. 65th St., Chicago.
Denison Engineering Co., Columbus, O.
Diamond Machine Co., Philadelphia, Pa.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Farquhar, A. B., Co., Ltd., York, Pa.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydropress Co., Inc., 570 Lexington Ave., New York, N. Y.
Lake Erie, Engineering Corp., Buffalo, N. Y.
Lapointe Machine Tool Co., Hudson, Mass.
Morgan Engineering Co., Alliance, O.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.
Williams, White & Co., Moline, Ill.
Wilson, K. R., Buffalo, N. Y.
Wood, R. D., Co., Philadelphia, Pa.

PRESSES, PERCUSSION

Wilson, K. R., Buffalo, N. Y.

PRESSES, SCREW

Ferracute Machine Co., Bridgeton, N. J.
General Mfg. Co., Detroit, Mich.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, SHEET METAL WORKING

Baldwin-Southwark Corp., Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., Cincinnati.
Clearing Mch. Co., 649 W. 65th St., Chicago.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., Racine, Wis.
Farquhar, A. B., Co., Ltd., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Mfg. Co., Hartford, Conn.
L & J Press Corp., Elkhart, Ind.
Lake Erie Engineering Corp., Buffalo, N. Y.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co., Cleveland.
V & O Press Co., Hudson, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, STRAIGHTENING

Baldwin-Southwark Corp., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Farquhar, A. B., Co., York, Pa.
General Mfg. Co., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Jones Machine Tool Wks., Inc., Valley Forge, Pa.
Morgan Engineering Co., Alliance, O.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Frew Machine Co., Philadelphia.
Gorton, George, Mch. Co., Racine, Wis.
Leland-Gifford Co., Worcester, Mass.
Morey Machinery Co., Inc., 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.

PULLEYS

Continental Machines, Inc., Minneapolis, Minn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hill Acme Co., Cleveland, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.

PULLEYS, FRICTION CLUTCH

Brown & Sharpe Mfg. Co., Providence, R. I.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

PUMPS, COOLANT, LUBRICANT AND OIL

Brown & Sharpe Mfg. Co., Providence, R. I.
Gray Mills Co., 208 West Ontario St., Chicago.
Ingersoll-Rand Co., 11 Broadway, New York.
Logansport Machine, Inc., Logansport, Ind.
Ruthman Machinery Co., Cincinnati.
Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, HYDRAULIC

Baldwin-Southwark Corp., Philadelphia, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hydropress Co., Inc., 570 Lexington Ave., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York.
Lapointe Machine Tool Co., Hudson, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.
Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.
Watson-Stillman Co., Roselle, N. J.

PUMPS, PNEUMATIC

Ingersoll-Rand Co., 11 Broadway, New York.

PUMPS, ROTARY

Tuthill Pump Co., 909 East 95th St., Chicago.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, etc.

PUNCHES, CENTERING

Cleveland Punch & Shear Works Co., Cleveland, O.

PUNCHING MACHINERY

Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co., Cleveland.
Watson-Stillman Co., Roselle, N. J.
Wiedemann Machine Co., Philadelphia.

PUNCHING AND RIVETING MACHINES

Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

PYROMETERS

Leeds & Northrup Co., Philadelphia.
Shore Instrument & Mfg. Co., Jamaica, N. Y.

RACK CUTTING MACHINES AND ATTACHMENTS

Gould & Eberhardt, Newark, N. J.

RACKS, GEAR, CUT

Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Hartford Special Mchry. Co., Hartford, Conn.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago.
Massachusetts Gear & Tool Co., Woburn, Mass.
Meisel Press Mfg. Co., Boston, Mass.
Philadelphia Gear Works, Philadelphia.
Stahl Gear & Machine Co., Cleveland.

REAMER HOLDERS

Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Landis Mch. Co., Inc., Waynesboro, Pa.
Lipe-Rollway Corporation, Syracuse, N. Y.
McCrosky Tool Corp., Meadville, Pa.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Warner & Swasey Co., Cleveland.

REAMERS

Barber-Colman Co., Rockford, Ill.
Black Drill Co., Cleveland, O.
Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Columbus Die, Tool & Mch. Co., Columbus, O.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corporation, Detroit.
Firth Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gammons-Hoagland Co., Manchester, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Lake Shore Tool Works Div. 816 N. Kostner Ave., Chicago.
Lipe-Rollway Corporation, Syracuse, N. Y.
Machinists Tool Grinding Co., 2834 W. Lake St., Chicago.
McCrosky Tool Corp., Meadville, Pa.
Mose Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Super Tool Co., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.

REAMERS, ADJUSTABLE

Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit.
Cleveland Twist Drill Co., Cleveland.
Davis Boring Tool Div., St. Louis, Mo.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Madison Mfg. Co., Muskegon, Mich.
McCrosky Tool Corp., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Rogers, John M., Tool Corp., Gloucester City, N. J.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

REAMERS, TAPER PIN

Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
Gammons-Hoagland Co., Manchester, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Lipe-Rollway Corporation, Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES

Van Norman Co., Springfield, Mass.

RECORDING INSTRUMENT FOR COUNTING

National Acme Co., Cleveland.

RECORDING INSTRUMENTS FOR ELECTRICITY

General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.

RECORDING INSTRUMENTS FOR PRESSURE

Leeds & Northrup Co., Philadelphia, Pa.

RECORDING INSTRUMENTS FOR SPEED

Leeds & Northrup Co., Philadelphia, Pa.

RECORDING INSTRUMENTS FOR TEMPERATURE

Leeds & Northrup Co., Philadelphia, Pa.

REELS, STOCK, STANDARD AND AUTOMATIC

S & S Mch. Wks., 4541 W. Lake St., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

REFRACTORIES, HEAT TREATING FURNACE

Norton Co., Worcester, Mass.

REGULATORS, TEMPERATURE

General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.

REMOVERS, JAPAN, ENAMEL, ETC.

Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., 26 Thames St., New York.

RHEOSTATS

Allen-Bradley Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.

RIVETERS, HYDRAULIC

Bethlehem Steel Co., Bethlehem, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Morgan Engineering Co., Alliance, O.
Wood, R. D., Co., Philadelphia, Pa.

RIVETERS, PNEUMATIC

Grant Mfg. & Mch. Co., Bridgeport, Conn.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Ingersoll-Rand Co., 11 Broadway, New York.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

RIVETING MACHINES

Buffalo Forge Co., Buffalo, N. Y.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Hanna Engineering Works, 1765 Elston Ave., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Peck, Stow & Wilcox Co., Southington, Conn.
Producto Machine Co., Bridgeport, Conn.

RIVET MAKING MACHINES

Hill Acme Co., Cleveland, Ohio.

ROUTERS, PORTABLE, RADIAL ARM, TURRET HEAD, ETC.

Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

RULES, STEEL

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Starrett, L. S., Co., Athol, Mass.

RUST PREVENTIVE

Houghton, E. F., & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., 26 Thames St., New York.
Quaker Chemical Products Corp., Conshohocken, Pa.
Scherr, George, Co., Inc., 126 Lafayette St., New York.

SAFETY GUARDS FOR PUNCH PRESSES

Taylor-Shantz, Inc., Rochester, N. Y.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment.

SANDERS

Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York.
Jarvis, Chas. L., Co., Middletown, Conn.
Jefferson Machine Tool Co., Cincinnati, O.
Porter-Cable Machine Co., Syracuse, N. Y.
Rotor Tool Co., Cleveland, O.
Skilsaw, Inc., 5039 Elston Ave., Chicago.
Stow Mfg. Co., Binghamton, N. Y.
Sundstrand Mch. Tool Co., Rockford, Ill.
Walls Sales Corp., 96 Warren St., New York.

SAW BLADES, HACK

Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Starrett, L. S., Co., Athol, Mass.

SAW FILING MACHINES

Wardwell Mfg. Co., Cleveland, O.

SAW SETTING MACHINES, CIRCULAR
Wardwell Mfg. Co., Cleveland, O.

SAW SHARPENING MACHINES
Earle Gear & Mch. Co., Philadelphia.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Wardwell Mfg. Co., Cleveland, O.

SAWING MACHINES, CIRCULAR
Consolidated Mch. Tool Corp., Rochester, N. Y.
Earle Gear & Mch. Co., Philadelphia.
Etna Machine Co., Toledo, O.
Motch & Merryweather Mchy. Co., Cleveland, O.

SAWING MACHINES, FRICTION
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SAWING MACHINES, METAL CUTTING BAND
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Avey Drilling Machine Co., Cincinnati.
Continental Machines, Inc., Minneapolis, Minn.
Delta Mfg. Co., Milwaukee, Wis.
Grob Brothers, Grafton, Wis.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SAWING MACHINES, POWER HACK
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Peerless Machine Co., Racine, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SAWING MACHINES, WOOD
Delta Mfg. Co., Milwaukee, Wis.

SAWS, CIRCULAR METAL CUTTING
Consolidated Mch. Tool Corp., Rochester, N. Y.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
Illinois Tool Wks., 2501 No. Keeler Ave., Chicago.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, HOLE
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.

SAWS, METAL CUTTING BAND
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Delta Mfg. Co., Milwaukee, Wis.
DoAll Co., Inc., Des Plaines, Ill.
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Starrett, L. S. Co., Athol, Mass.
Tannewitz Works, Grand Rapids, Mich.
Walker-Turner Co., Inc., Plainfield, N. J.
Wells Manufacturing Corp., Three Rivers, Mich.

SAWS, PORTABLE ELECTRIC
Skilsaw, Inc., 5039 Elston Ave., Chicago.

SAWS, SCREW SLOTTING
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Standard Tool Co., Cleveland, O.
Starrett, L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, HAND AND POWER
Anderson Bros. Mfg. Co., Rockford, Ill.

SCREW CUTTING TOOLS—See Taps and Dies.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Errington Mechanical Laboratory, 170 Broadway, New York.
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Ingersoll-Rand Co., 11 Broadway, New York.
Jarvis, Chas. L., Co., Middletown, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Wolcott Ave., Chicago

SCREW MACHINES, AUTOMATIC, SINGLE AND MULTIPLE SPINDLE
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., Cleveland, O.
Cone Automatic Machine Co., Inc., Windsor, Vt.
Foote-Burt Co., Cleveland, O.
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland.
New Britain-Gridley Mch. Div., New Britain Machine Co., New Britain, Conn.
Scherr, George, Co., Inc., 126 Lafayette St., New York.

SCREW MACHINES, HAND
See also Lathes, Turret.
Acme Machine Tool Co., Cincinnati, O.
Bardons & Oliver, Inc., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Gibbs, Thomas B., & Co., Delavan, Wis.
Gisholt Mch. Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Machine Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Simmons Machine Tool Corp., Albany, N. Y.
Stark Tool Co., Waltham, Mass.
Warner & Swasey Co., Cleveland.

SCREW MACHINE TOOLS AND EQUIPMENT
Bardons & Oliver, Inc., Cleveland, O.
Brown & Sharpe Mfg. Co., Providence.
Cleveland Automatic Machine Co., Cleveland, O.
Gisholt Mch. Co., Madison, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
New Britain-Gridley Mch. Div., New Britain Machine Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
R & L Tools, Nicetown, Philadelphia.
Warner & Swasey Co., Cleveland.

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Vard, Inc., Pasadena, Calif.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SCREW PLATES
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Butterfield Div. Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.

SCREWS, CAP, SET, SAFETY SET AND MACHINE
Allen Mfg. Co., Hartford, Conn.
American Screw Co., Providence, R. I.
Central Screw Co., 3511 Shields Ave., Chicago.
Chandler Products Corp., Cleveland, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Co., New Britain, Conn.
General Screw Mfg. Co., 1228 W. Monroe St., Chicago, Ill.
Harper, H. M., Co., Providence, R. I.
Holo-Krome Screw Corp., Hartford, Conn.
International Screw Co., Detroit, Mich.
Lamson & Sessions Co., Cleveland.
Manufacturers Screw Products, 209 W. Hubbard St., Chicago 10, Ill.
Milford Rivet & Machine Co., Milford, Conn.
National Acme Co., Cleveland.
National Screw & Mfg. Co., Cleveland.
New England Screw Co., Keene, New Hampshire.
Parker, Chas., Co., Meriden, Conn.
Parker-Kalon Corp., 200 Varick St., New York.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., 5700 W. Roosevelt Rd., Chicago.
Reading Screw Co., Norristown, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Southington Hardware Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, SELF-TAPPING DRIVE
Parker-Kalon Corp., 200 Varick St., New York.

SCREWS, THUMB
American Screw Co., Providence, R. I.
Parker-Kalon Corp., 200 Varick St., New York.
Williams, J. H., & Co., 225 Lafayette St., New York.

SEALS AND RETAINERS, OIL OR GREASE
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.

SEAMLESS STEEL TUBING
See Tubing, Seamless Steel.

SECOND HAND MACHINERY, ETC.
Cincinnati Machinery & Supply Co., Cincinnati.
Eastern Machinery Co., Cincinnati.
Emerman Machinery Corp., 875 W. 120th St., Chicago 43, Ill.
General Machinery Corp., Boston, Mass.
Interstate Machinery Co., Chicago, Ill.
Jefferson Machine Tool Co., Cincinnati, O.
Miles Machinery Co., Saginaw, Mich.
Morey Mchry. Co., Inc., 410 Broome St., New York.
Simmons Machine Tool Corp., Albany, N. Y.
Wigglesworth Machinery Co., Cambridge, Mass.

SEPARATORS, CENTRIFUGAL OIL
National Acme Co., Cleveland.
Tolhurst Centrifugal Div., American Machine & Metals, Inc., East Moline, Ill.

SHAFTING, STEEL
Bethlehem Steel Co., Bethlehem, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Tube Co. (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Standard Pressed Steel Co., Jenkintown, Pa.
Union Drawn Steel Div., Massillon, Ohio.

SHAFTS, FLEXIBLE
Haskins, R. G., Co., 617 S. California Ave., Chicago.
Jarvis, Chas. L., Co., Middletown, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand, N. A., & Co., 5001 N. Walcott Ave., Chicago

SHAFTS, HOLLOW BORED
American Hollow Boring Co., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, TURNING AND GROUND
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Union Drawn Steel Div., Massillon, Ohio.

SHAPERS
American Tool Works Co., Cincinnati.
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Shaper Co., Cincinnati.
Machinery Mfg. Co., Los Angeles, Calif.
Ohio Machine Tool Co., Kenton, O.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rockford Mch. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati.

SHAPERS, VERTICAL
Hanson-Whitney Mfg. Co., Hartford, Conn.
Jones Machine Tool Wks., Inc., Valley Forge, Pa.
Pratt & Whitney Co., West Hartford, Conn.
Rhodes Manufacturing Co., Waltham, Mass.
Rockford Machine Tool Co., Rockford, Ill.

SHAPES, STRUCTURAL
Bethlehem Steel Co., Bethlehem, Pa.
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

SHEARING MACHINERY
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hanniffin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydropress Co., Inc., 570 Lexington Ave., New York, N. Y.
Morgan Engineering Co., Alliance, O.
National Automatic Tool Co., Richmond, Ind.
Niagara Mch. & Tool Wks., Buffalo.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.
Yoder Co., Cleveland, O.

SHEARS, ROTARY
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Wks., Buffalo.
Peck, Stow & Wilcox Co., Southington, Conn.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Union Twist Drill Co., Athol, Mass.

SHEARS, SQUARING
Cincinnati Shaper Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Wks., Buffalo.
Peck, Stow & Wilcox Co., Southington, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEET METALS
American Brass Co., Waterbury, Conn.
Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SHEETS, IRON AND STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Follansbee Steel Corp., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

SHEETS, PERFORATED
Chicago Perforating Co., 2445 W. 25th Place, Chicago.

SINE BARS
Starrett, L. S., Co., Athol, Mass.

SLEEVES
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1902 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES
Baker Brothers, Inc., Toledo, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Jones Machine Tool Wks., Inc., Valley Forge, Pa.
Rhodes Manufacturing Co., Waltham, Mass.
Rockford Mch. Tool Co., Rockford, Ill.
Sellers, Wm., & Co., Inc., Philadelphia.

SOCKETS
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit.
Pratt & Whitney Co., West Hartford, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York.

SOLDER FOR ALUMINUM AND CAST IRON
Cramp Brass & Iron Foundries Div., Philadelphia, Pa.

SPECIAL MACHINERY AND TOOLS
Baird Machine Co., Stratford, Conn.
Baldwin-Southwark Corp., Philadelphia, Pa.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F., & John, Co., Rockford, Ill.
Baush Machine Tool Co., Springfield, Mass.
Bayard, M. L., & Co., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Wks., Philadelphia.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Machine Co., Cambridge, Mass.
Columbus Die, Tool & Machine Co., Columbus, O.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis Boring Tool Co., Inc., St. Louis, Mo.
Denison Engineering Co., Columbus, O.
Earle Gear & Mch. Co., Philadelphia.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Ex-Cell-O Corp., Detroit.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Gairing Tool Co., Detroit.
Gisholt Mch. Co., Madison, Wis.
Gorton, George, Mch. Co., Racine, Wis.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hanniffin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hartford Special Mchy. Co., Hartford, Conn.
Hill Acme Co., Cleveland, O.
Jefferson Machine Tool Co., Cincinnati, O.
Jones Machine Tool Wks., Inc., Valley Forge, Pa.
Lake Erie Engineering Corp., Buffalo, N. Y.
Lipe-Rollway Corporation, Syracuse, N. Y.
Modern Machine Corp., Brooklyn, N. Y.
Moline Tool Co., Moline, Ill.
Morgan Engineering Co., Alliance, O.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland.
National Tool Co., Cleveland, O.
National Twist Drill & Tool Co., Detroit.
New Britain-Gridley Mch. Div., New Britain Machine Co., New Britain, Conn.
New Jersey Gear & Mfg. Co., Newark, N. J.
Niagara Mch. & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pollak Mfg. Co., Arlington, N. J.
Pratt & Whitney Co., West Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Ruthman Machinery Co., Cincinnati.
S. & S. Mch. Works, 4541 W. Lake St., Chicago.
Sundstrand Mch. Tool Co., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
U. S. Tool Company, Inc., Ampere, N. J.
V & O Press Co., Hudson, N. Y.
Waltham Mch. Wks., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Cleveland Worm & Gear Co., Cleveland.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Davis & Thompson Co., Milwaukee, Wis.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Ganschow Gear Co., 14 N. Morgan St., Chicago.
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston, Mass.
James, D. O. Mfg. Co., 1120 W. Monroe St., Chicago.
Janette Mfg. Co., 556 W. Monroe St., Chicago.
Master Electric Co., Dayton, Ohio.
Michigan Tool Co., Detroit, Mich.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

SPINDLES, GRINDING
Ex-Cell-O Corporation, Detroit.
Pope Machinery Corp., Haverhill, Mass.

SPINDLES, HOLLOW BORED
American Hollow Boring Co., Erie, Pa.

SPINNING LATHES
See Chucking Machines.

SPRING COILING AND FORMING MACHINERY
Baird Machine Co., Stratford, Conn.

SPRINGS, WIRE
Hunter Pressed Steel Co., Lansdale, Pa.

SPROCKET CHAINS
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Grant Gear Works, Inc., Boston, Mass.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.

SPROCKETS
Atlantic Gear Works, Inc., 124 Lafayette St., New York.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Foote Bros. Gear & Machine Corp., 5319 S. Western Blvd., Chicago.
Grant Gear Works, Inc., Boston, Mass.
Hartford Special Mchry. Co., Hartford, Conn.
Link-Belt Co., 307 N. Michigan Ave., Chicago.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.
Whitney Chain & Mfg. Co., Hartford, Conn.

STAMPINGS, SHEET METAL
Jefferson Machine Tool Co., Cincinnati, O.
Rogers, Dayton, Mfg. Co., Minneapolis, Minn.
Taylor-Shantz, Inc., Rochester, N. Y.

STAMPS, STEEL, AND MARKING DIES
Noble & Westbrook Mfg. Co., Hartford, Conn.
Pittsburgh Stamp Co., Inc., Pittsburgh.

STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.
National Tube Co., (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL ALLOYS—See Alloys-steels.

STEEL BARS—See Bars, steel.

STEEL, COLD DRAWN
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel Co., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
National Tube Co., (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Union Drawn Steel Div., Massillon, Ohio.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, COMPOSITE TOOL AND DIE
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL, HIGH SPEED TOOL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Co., Latrobe, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Cambridge, Mass.

STEEL, MACHINE
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Union Drawn Steel Div., Massillon, Ohio.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, RUSTLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.
Republic Steel Co., Cleveland, O.

STEEL, SPECIAL ANALYSIS
Republic Steel Corp., Cleveland, O.

STEEL STAMPS
Sossner, Inc., New York, N. Y.

STEEL, STAINLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
National Tube Co., (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.
Union Drawn Steel Div., Massillon, Ohio.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

STEEL, STRIP AND SHEET
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

STEEL, ZINC, TIN AND COPPER COATED STRIP
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STELLITE
Haynes Stellite Co., Kokomo, Ind.

STOCKS, DIE
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oster Manufacturing Co., Cleveland, O.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.

STONES, OIL OR SHARPENING
Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHT EDGES
Jones Machine Tool Wks., Inc., Valley Forge, Pa.
Starrett, L. S., Co., Athol, Mass.

STRAIGHTENING MACHINERY
Baldwin-Southwark Corp., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
General Mfg. Co., Detroit, Mich.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Lake Erie Engineering Corp., Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Waterbury Farrel Fdry. & Mch. Co., Waterbury, Conn.

STUD SETTERS
Errington Mechanical Laboratory, 170 Broadway, New York.
Modern Tool Wks., Rochester, N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.

SUB PRESSES
Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
U. S. Tool Co., Ampere, N. J.
Waltham Mch. Wks., Waltham, Mass.

SUPERFINISHING MACHINES
Norton Co., Worcester, Mass.

SURFACE PLATES—See Plates, Surface.

SWAGING MACHINES
Cincinnati Shaper Co., Cincinnati, O.
Etna Machine Co., Toledo, O.
Torrington Co., Torrington, Conn.

SWITCHES
Allen-Bradley Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
National Acme Co., Cleveland, O.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

TACHOMETERS
Leeds & Northrup Co., Philadelphia, Pa.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Veeder-Root, Inc., Hartford, Conn.

TAPER PINS, STANDARD
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.

TAP EXTENSIONS
Allen Mfg. Co., Hartford, Conn.

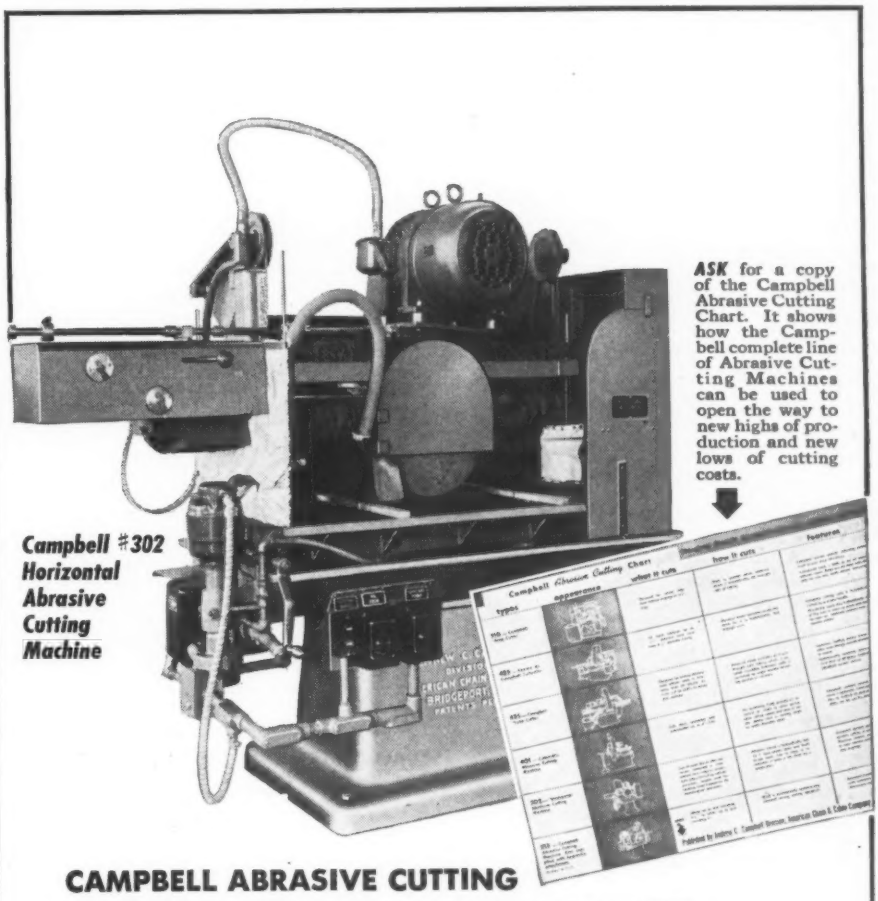
TAP HOLDERS
Errington Mechanical Laboratory, 170 Broadway, New York.
Gairing Tool Co., Detroit.
McCrosky Tool Corp., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Brown & Sharpe Mfg. Co., Providence.
Buhr Machine Tool Co., Ann Arbor, Mich.
Errington Mechanical Laboratory, 170 Broadway, New York.
Ettco Tool Co., Brooklyn, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., Worcester, Mass.
McCrosky Tool Corp., Meadville, Pa.
Modern Tool Wks., Rochester, N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.

TAPPING MACHINES
Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Avey Drilling Machine Co., Cincinnati.
Baker Brothers, Inc., Toledo, O.
Bakewell Mfg. Co., Los Angeles, Calif.
Barnes Drill Co., Rockford, Ill.
Barnes, W. F., & John, Co., Rockford, Ill.
Baush Machine Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati, O.
Buhr Machine Tool Co., Ann Arbor, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Elgin Tool Wks., Inc., Berteau & Ravenswood Ave., Chicago.
Frew Machine Co., Philadelphia.
Geometric Tool Co., New Haven, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hill Acme Co., Cleveland, Ohio.
Haskins, R. G., Co., 617 So. California Ave., Chicago.
Hoefer Mfg. Co., Freeport, Ill.
Jarvis, Chas. L., Co., Middletown, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Modern Tool Wks., Rochester, N. Y.
Moline Tool Co., Moline, Ill.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago.
Rickert-Shafer Co., Erie, Pa.

TAPPING MACHINES, NUT
Hill Acme Co., Cleveland, Ohio.

TAPS
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.



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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Pratt & Whitney Co., West Hartford, Conn.
Sossner, Inc., 161 Grand St., New York.
Standard Tool Co., Cleveland, O.
Threadwell Tap & Die Co., Greenfield, Mass.
Vard, Inc., Pasadena, Calif.
Woodworth, N. A., Co., Detroit 20, Mich.

TAPS, COLLAPSING

Geometric Tool Co., New Haven, Conn.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Wks., Rochester, N. Y.
Murchey Mch. & Tool Co., Detroit.
National Acme Co., Cleveland.
Rickert-Shafer Co., Erie, Pa.

TESTING EQUIPMENT, TENSION COMPRESSION, FATIGUE, ETC.

Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.

THERMOMETER, INDICATING AND RECORDING

Leeds & Northrup Co., Philadelphia, Pa.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence.
Eastern Machine Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Mch. Co., Bridgeport, Conn.
Hill Acme Co., Cleveland, Ohio.
Landis Mch. Co., Inc., Waynesboro, Pa.
Lees-Bradner Co., Cleveland.
Modern Tool Works, Rochester, N. Y.
Murchey Mch. & Tool Co., Detroit.
Oster Manufacturing Co., Cleveland, O.
Pratt & Whitney Co., West Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston.
Rogers Machine Works, Inc., Buffalo 7, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Eastern Machine Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Hill Acme Co., Cleveland, Ohio.
Landis Mch. Co., Inc., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Oster Manufacturing Co., Cleveland, O.
Peerless Machine Co., Racine, Wis.
Pratt & Whitney Co., West Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Rickert-Shafer Co., Erie, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

THREAD GAGES—See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport, Conn.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia, Pa.
Hanson-Whitney Mch. Co., Hartford, Conn.
Lees-Bradner Co., Cleveland.
Plan-O-Mill Corp., Hazel Park, Mich.
Pratt & Whitney Co., West Hartford, Conn.
Waltham Mch. Wks., Waltham, Mass.

THREAD ROLLING MACHINES

Hill Acme Co., Cleveland, Ohio.
Peck, Stow & Wilcox Co., Southington, Conn.
V & O Press Co., Hudson, N. Y.

TIN AND TERNE PLATES

Bethlehem Steel Co., Bethlehem, Pa.

TOOL BITS, HIGH SPEED STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Barber-Colman Co., Rockford, Ill.
Black Drill Co., Cleveland, O.
Carpenter Steel Co., Reading, Pa.
Darwin & Milner, Inc., Cleveland 13, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

TOOL BITS, SPECIAL ALLOY

Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Kokomo, Ind.

TOOL GRINDERS—See Grinders for Sharpening Turning and Planing Tools.

TOOL HEADS, ADJUSTABLE

Gairing Tool Co., Detroit.

TOOLHOLDERS

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland.
Gairing Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Lovejoy Tool Co., Inc., Springfield, Vt.
Michigan Tool Co., Detroit, Mich.
O.K. Tool Co., Inc., Shelton, Conn.
R and L Tools, Nicetown, Philadelphia.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., 1903 S. Rockwell St., Chicago. (Turret)
Slocomb, J. T., Co., Providence, R. I.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

TOOLMAKERS' INSTRUMENTS

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 126 Lafayette St., New York.
Starrett, L. S., Co., Athol, Mass.
Vard, Inc., Pasadena, Calif.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

TOOLS, CARBIDE-TIPPED

Carboloy Co., Inc., Detroit.
Ex-Cell-O Corporation, Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Super Tool Co., Detroit, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, LATHE, SHAPER AND PLANER

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Bokum Tool Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis. (For Lathes Only)
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Wks., 2501 N. Keeler Ave., Chicago.
Jones & Lamson Mch. Co., Springfield, Vt.
Kennametal, Inc., Latrobe, Pa.
Kyle-Johnson Mch. Co., Los Angeles 15, Cal.
Michigan Tool Co., Detroit, Mich.
O.K. Tool Co., Inc., Shelton, Conn.
Ready Tool Co., Bridgeport, Conn.
Slocomb, J. T., Co., Providence, R. I.
Super Tool Co., Detroit, Mich.
Warner & Swasey Co., Cleveland.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.
Wagner Electric Co., St. Louis, Mo.

TRANSMISSION MACHINERY

See Hangers, Shafting, Pulleys, Clutches, Couplings, Belting, Chains, etc.

TRANSMISSION, VARIABLE SPEED

Continental Machines, Inc., Minneapolis, Minn.
Link-Belt Co., Philadelphia 40, Pa.
Reeves Pulley Co., Columbus, Ind.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., Bridgeport, Conn.

TUBING, BRASS AND COPPER

American Brass Co., Waterbury, Conn.

TUBING, FLEXIBLE

Chicago Metal Hose Corp., Maywood, Ill.
Titeflex Metal Hose Co., North Bergen, N. J.

TUBING, STAINLESS STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Chicago Metal Hose Corp., Maywood, Ill.
National Tube Co. (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.

TUBING, STEEL AND SEAMLESS STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York.
National Tube Co. (U. S. Steel Corp., Div.), Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.
Timken Roller Bearing Co., Canton, O.

TUMBLING BARRELS

Baird Machine Co., Stratford, Conn.

TUNGSTEN CARBIDE

Carboloy Co., Inc., Detroit.
Firth-Sterling Steel Co., McKeesport, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Super Tool Co., Detroit, Mich.

TWIST DRILLS—See Drills, Twist.

UNIVERSAL JOINTS

Baush Machine Tool Co., Springfield, Mass.

V-BELTS

Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.

VALVES AND FITTINGS

Weatherhead Co., Cleveland, O.

VALVES, HYDRAULIC

Baldwin-Southwark Corp., Philadelphia, Pa.
Barnes, John S., Corp., Rockford, Ill.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Logansport Machine, Inc., Logansport, Ind.
Sundstrand Mch. Tool Co., Rockford, Ill.
Vard, Inc., Pasadena, Calif.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., Philadelphia, Pa.

VALVES, PNEUMATIC

Hanna Engineering Works, 1765 Elston Ave., Chicago
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

VIBRATION ISOLATION

Keldur Corp., 420 Lexington Ave., New York, N. Y.

VISES, BENCH

Avey Drilling Machine Co., Cincinnati, O.
Desmond-Stephan Mfg. Co., Urbana, Ill.
Fenn Mfg. Co., Hartford, Conn.
Jefferson Machine Tool Co., Cincinnati, O.

VISES, MACHINE

Armstrong-Blum Mfg. Co., 5743 Bloomingdale Ave., Chicago.
Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Avey Drilling Machine Co., Cincinnati, O.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Desmond-Stephan Mfg. Co., Urbana, Ill.
Graham Mfg. Co., Inc., Greenwich, R. I.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Jefferson Machine Tool Co., Cincinnati.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Logansport Machine, Inc., Logansport, Ind.
Sheldon Mch. Co., 4246 N. Knox Ave., Chicago.

VISES, PIPE

Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

VISES, PLANER AND SHAPER

Cincinnati Planer Co., Cincinnati.
Cincinnati Shaper Co., Cincinnati.
Graham Mfg. Co., Inc., E. Greenwich, R. I.
Rockford Machine Tool Co., Rockford, Ill.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, LOCK

National Lock Washer Co., Newark, N. J., and Milwaukee, Wis.

WASHERS, SPRING

National Lock Washer Co., Newark, N. J., and Milwaukee, Wis.

WASHING MACHINES

Tolhurst Centrifugal Div., American Machine & Metals, Inc., East Moline, Ill.

WELDING AND CUTTING EQUIPMENT OXY-ACETYLENE

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Linde Air Products Co., 30 E. 42nd St., New York.

WELDING AND CUTTING GASES

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WELDING EQUIPMENT, ELECTRIC ARC

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General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
Master Electric Co., Dayton, Ohio.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

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Cullen-Friestedt Co., 1305 So. Kilbourn Ave., Chicago.
Ransome Machinery Co., Dunellen, N. J.

WIRE

Bethlehem Steel Co., Bethlehem, Pa.

WIRE FORMING MACHINERY

Baird Machine Co., Stratford, Conn.
U. S. Tool Co., Inc., Ampere, N. J.

WIRE NAIL MACHINERY

Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago.

WOODWORKING MACHINERY

Jefferson Machine Tool Co., Cincinnati, O.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Sidney Machine Tool Co., Sidney, O.
Walker-Turner Co., Inc., Plainfield, N. J.

WORM DRIVES

Cleveland Worm & Gear Co., Cleveland.
Link-Belt Co., Philadelphia 40, Pa.
Michigan Tool Co., Detroit, Mich.
Philadelphia Gear Works, Philadelphia, Pa.

WRENCHES

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Greene, Tweed & Co., Bronx Blvd. & 238th St., New York.
Standard Tool Co., Cleveland, O.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

WRENCHES, DETACHABLE SOCKET

Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

WRENCHES, PIPE

Greenfield Tap & Die Corp., Greenfield, Mass.

WRENCHES, RATCHET

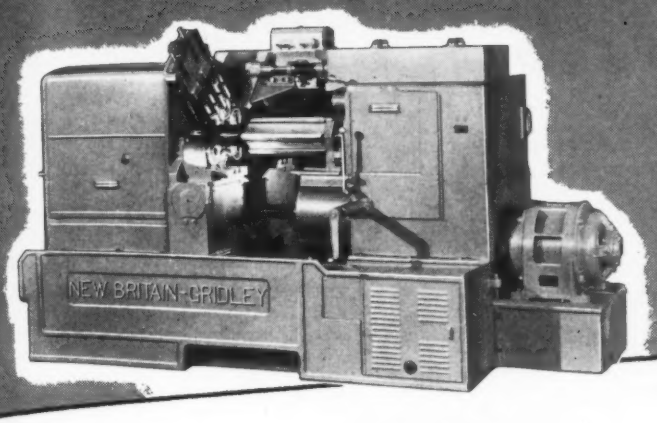
Greene, Tweed & Co., Bronx Blvd. & 238th St., New York.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.

WRENCHES, TAP

Besly, Chas., H., & Co., 120-B N. Clinton St., Chicago.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., West Hartford, Conn.
Standard Tool Co., Cleveland, O.

WRENCHES, TORQUE MEASURING

Sturtevant, P. A., Co., Addison, Ill.
Williams, J. H., & Co., 225 Lafayette St., New York, N. Y.



First

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AUTOMATICS

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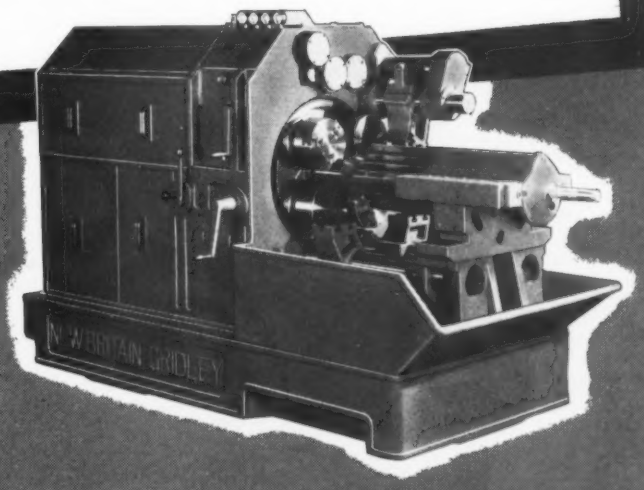
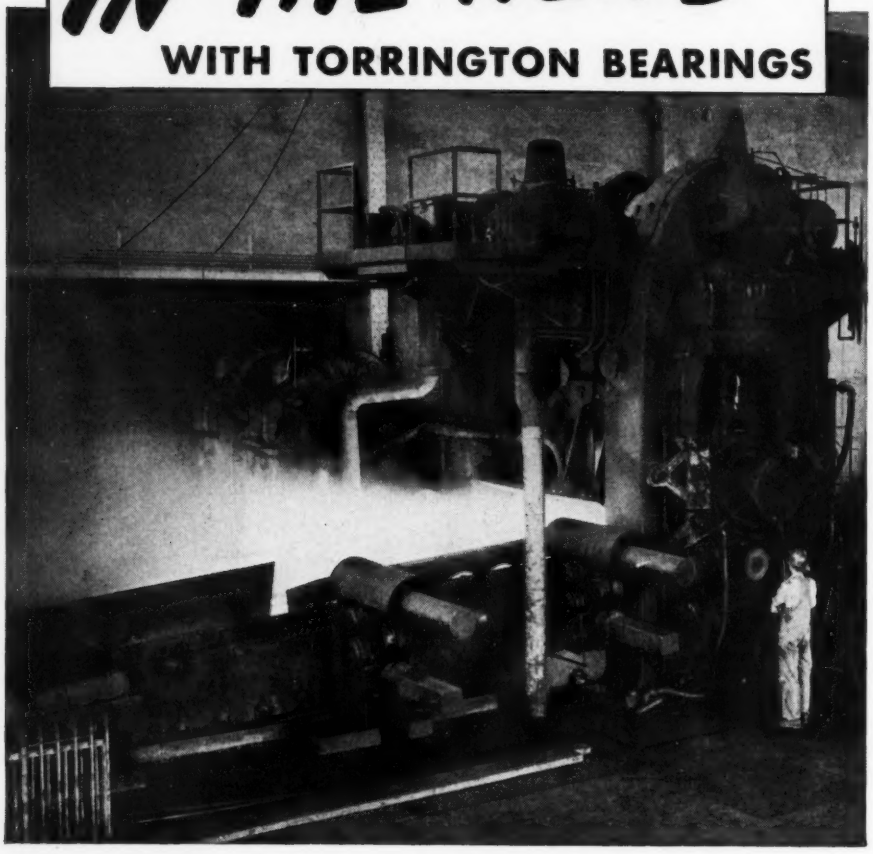
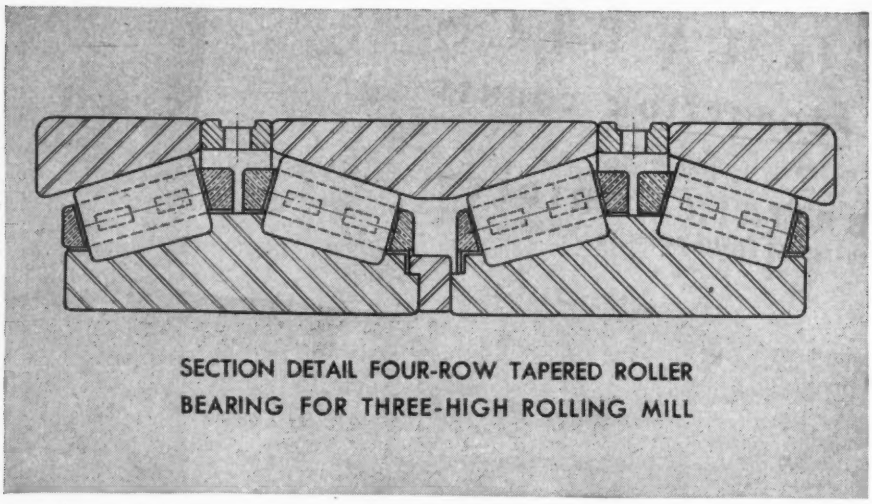
MACHINE DIVISION • THE NEW BRITAIN MACHINE CO. • NEW BRITAIN, CONN.



IN THE NEWS
WITH TORRINGTON BEARINGS

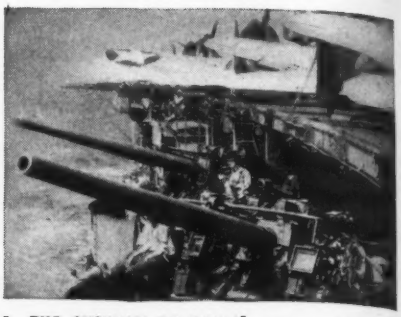


CALIFORNIA STEEL PLANT of Kaiser Company Inc.'s Iron & Steel Division went into operation last fall, rolling out steel sheets and plates for the West Coast industry's needs. This big, three-high rolling mill, built by Lewis-Foundry & Machine, is equipped with four-row tapered roller bearings illustrated below, designed and built by Torrington's Bantam Bearings Division.

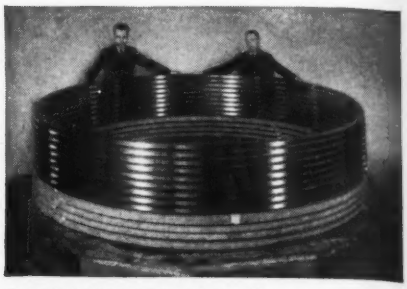


SECTION DETAIL FOUR-ROW TAPERED ROLLER BEARING FOR THREE-HIGH ROLLING MILL

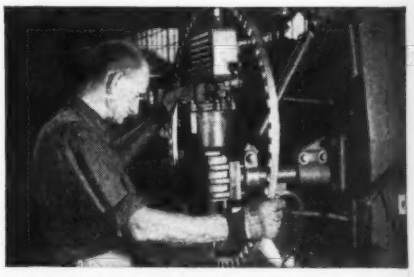
X-SECTION of the 21.500" OD 4-row tapered roller bearing used on the working rolls of the three-high mill shown at top. There are 43 rollers per row. Radial capacity at 100 R.P.M. is 550,000 pounds; thrust capacity, 168,000 pounds. Design and manufacture of large and special bearings to precision and ultra-precision limits is a major part of the service of Torrington's Bantam Bearings Division.



1. THE CURTAIN OF FIRE thrown up by anti-aircraft batteries of our modern Naval units is the most effective ever developed. The extreme accuracy and precision of the gun control mechanisms are aided by the use of anti-friction bearings like those shown below.



2. TEN FEET IN DIAMETER, these are races for gun mount bearings for the 5" twin anti-aircraft guns. Held to tolerances of .002" in diameter, .001" parallelism, Bantam engineers devised special methods for machining and gauging the giant rings where the change of a few degrees in temperature would cause dimensional changes greater than the specified tolerance.



3. RETAINING CAGES STAMPED FROM STEEL were also designed by Bantam engineers to reduce weight, conserve critical material. Shown here is a typical "stamped" cage for 33-inch diameter thrust roller gun mount bearing. Retaining cage for the 10-foot diameter bearings are of similar design, but constructed in eight segments and welded together on assembly. For your special bearing needs, you will find Torrington's experience in the design and manufacture of anti-friction bearings of every major type helpful in the solution of your bearing problems. TURN TO TORRINGTON for your bearing needs.

ARMY E NAVY

TORRINGTON BEARINGS

STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL

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SOUTH BEND 21, INDIANA

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The World's Largest Manufacturer of Blast Cleaning and Dust Collecting Equipment

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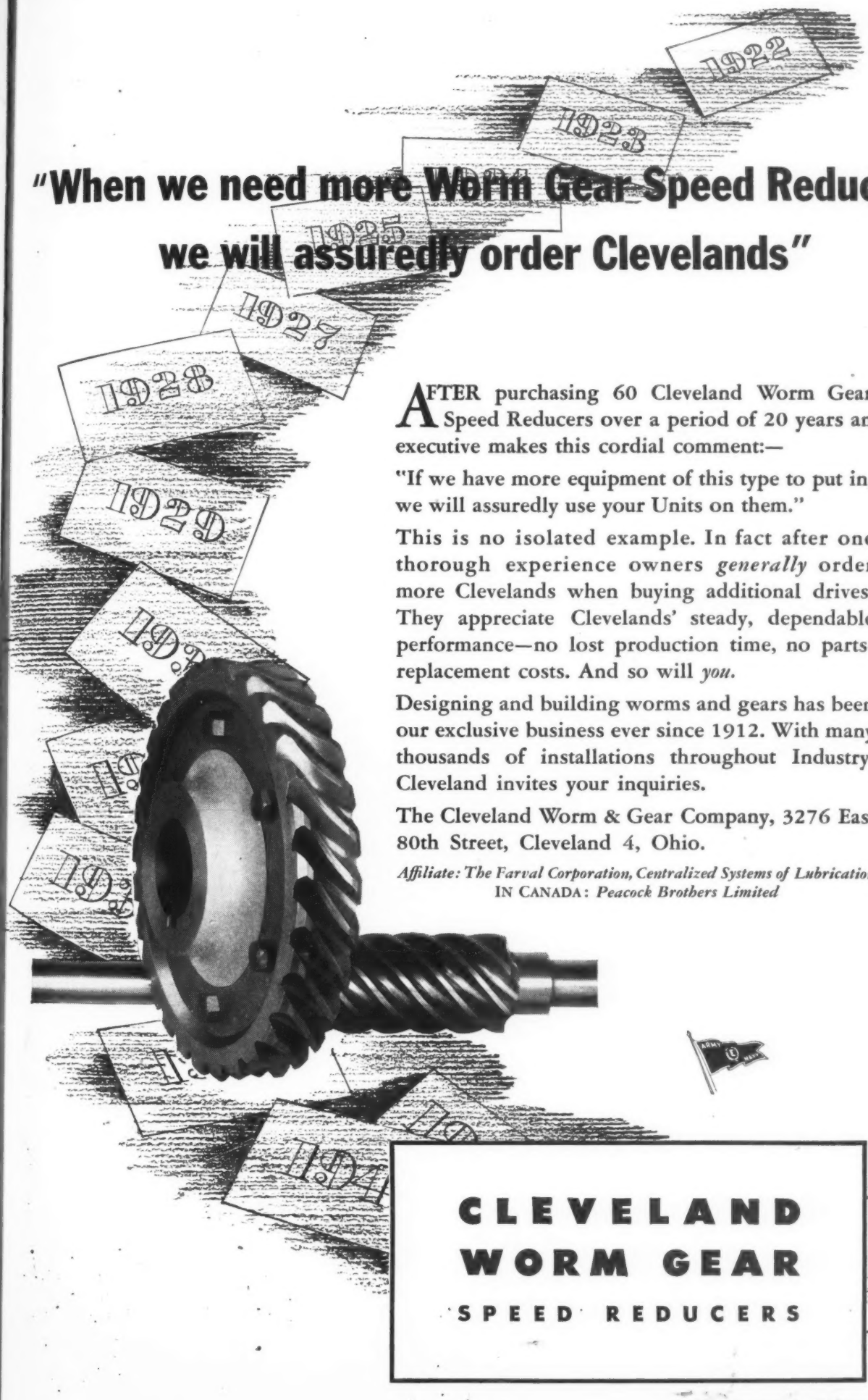

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"If we have more equipment of this type to put in, we will assuredly use your Units on them."

This is no isolated example. In fact after one thorough experience owners *generally* order more Clevelands when buying additional drives. They appreciate Clevelands' steady, dependable performance—no lost production time, no parts-replacement costs. And so will *you*.

Designing and building worms and gears has been our exclusive business ever since 1912. With many thousands of installations throughout Industry, Cleveland invites your inquiries.

The Cleveland Worm & Gear Company, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication
IN CANADA: *Peacock Brothers Limited*

CLEVELAND WORM GEAR SPEED REDUCERS

TORSIONAL FORMING PRESS

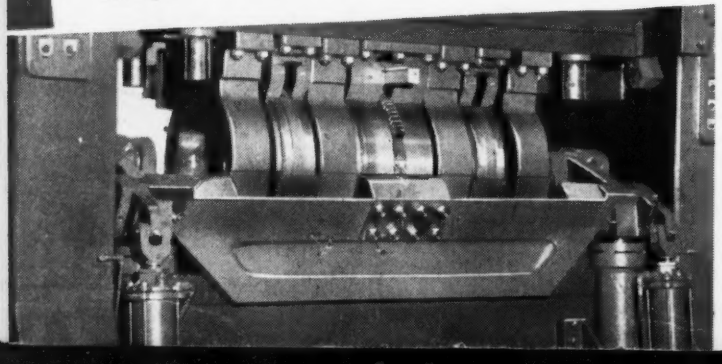
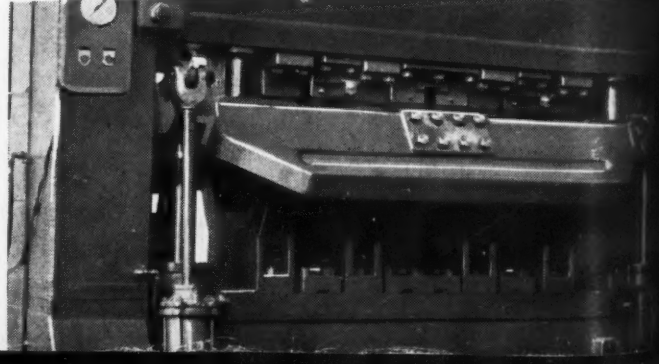
A new, high speed method of positioning the throws of crankshafts is provided by this Clearing Hydraulic Press. The press offers many advantages, the most important being (1) bends produced in forging operations are accurately straightened; (2) crank pins are turned to correct positions in one fast operation; (3) crankshaft is rigidly and completely held during the entire forming operation to assure accuracy of twist and maintain perfect alignment; and (4) work is easy to load and unload since dies open to full length of work, and knockouts automatically loosen finished work.

The dies of this press receive a forged alloy steel crankshaft, with all the crank pins in one plane. The press as designed may be adjusted for twisting any six-pin crankshaft, where the crank pins and cheeks must be correlated to the conventional angularity of 120°. The bed is 90" long and die shoes are longitudinally adjustable to accommodate die inserts for any crankshaft up to 66" in length.

While your production may not concern crankshafts, this particular press is a good example of Clearing's willingness and ability to tackle and solve any problem presented. If you have a production operation, whether commonplace or unusual, where presses may be required, your inquiry is invited. Experience proves you can consult Clearing with confidence. Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois

CLEARING
HYDRAULIC
AND
MECHANICAL
PRESSES

CMC CLEARING

Patent Pending

An assembly of four stationary and three rotating dies (below) hold the crankshaft and turn the crank pins. The stationary dies straighten and clamp the crankshaft under 250 tons pressure and maintain the forged position of one pair of crank pins. The rotating dies twist the other two pairs of crank pins. Controlled by a beam (below, right) on the front of the press, the center rotating die twists the center pair of crank pins 60°. The other two rotating dies, controlled by a beam on the back of the press, twist the remaining pair of pins 60°, so that 120° intervals exist between the three pairs of crank pins. The two beams are pivoted at their ends on common shafts which align with the centerline of the dies and work. Die design and knockouts permit easy removal of work. Pneumatic and hydraulic controls return dies to open and neutral positions, ready for a new work cycle.